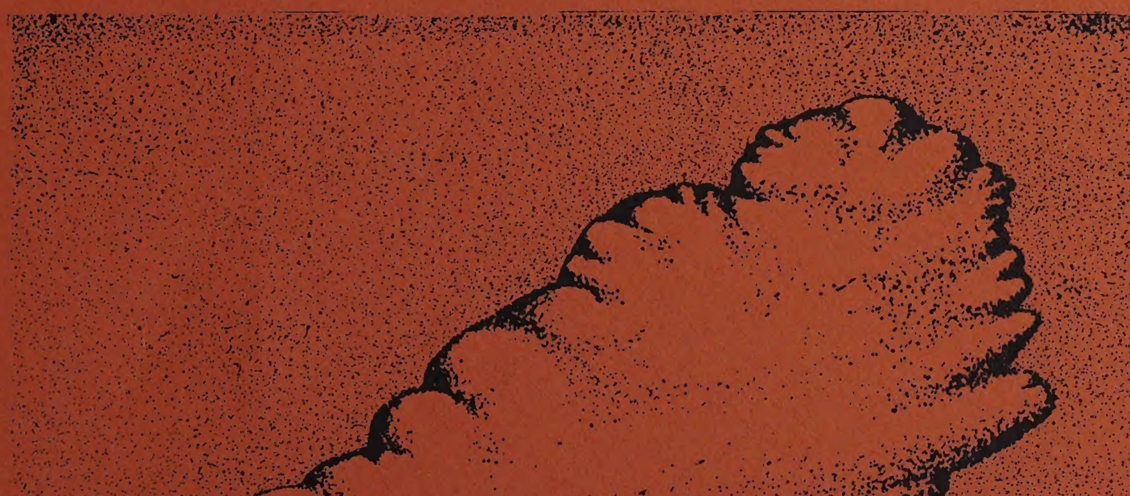
UNITE DEPARTMENT OF THE INTERIOR

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

PREPARED BY THE BUREAU OF LAND MANAGEMENT

VOLUME 1 OF 2



PROPOSED
1977 OUTER CONTINENTAL SHELF
OIL AND GAS LEASE SALE
GULF OF MEXICO

OCS SALE 45

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

PROPOSED
1977
OCS OIL AND GAS LEASE SALE

UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BLM

Curt Berklund

DIRECTOR

Summary: Proposed OCS Lease Sale No. 45

(X) Draft ( ) Final Environmental Satement

Department of the Interior, Bureau of Land Management, New Orleans Outer Continental Shelf Office

1. Proposed Oil and Gas Lease Sale, Gulf of Mexico Outer Continental Shelf

(X) Administrative ( ) Legislative Action

2. One hundred and twenty tracts comprising 235,875 hectares (582,856 acres) are proposed for leasing action. The tracts are located offshore Texas and Louisiana in water depths ranging from 4 m to 183 m and a distance from shore from 5 km to 293 km. If implemented, this sale is tentatively scheduled to be held in December 1977.

3. All tracts offered pose some degree of pollution risk to the environment. The risk potential is related to adverse effects on the environment and other resource uses which may result from accidental or chronic oil spillage. Each tract offered has been subjected to a matrix analysis technique in order to evaluate significant environmental impacts should leasing and subsequent oil and gas exploration and production take place.

4. Alternatives to the proposed action:

A. Hold the Sale in Modified Form
B. Withdraw the Sale
C. Delay the Sale

5. Comments have been requested from the following:

Department of Commerce
Department of Defense
  Department of the Army, Corps of Engineers
Department of the Interior
  Bureau of Mines
  Bureau of Outdoor Recreation
  U.S. Fish and Wildlife Service
  U.S. Geological Survey
  National Park Service
Department of Transportation
  Materials Transportation Bureau
  U.S. Coast Guard
Advisory Council on Historic Preservation
Energy Research and Development Administration
Nuclear Regulatory Commission
Environmental Protection Agency
Federal Energy Administration
Federal Power Commission
Marine Mammal Commission
State of Louisiana
State of Texas

6. Comments on this Draft Environmental Impact Statement are invited from other interested parties in addition to those agencies mentioned above. Comments should be addressed to:

Manager, New Orleans Outer Continental Shelf Office
Suite 841 Hale Boggs Federal Building
500 Camp Street
New Orleans, Louisiana 70130

In order to be considered for the Final Enviro mental Impact Statement, comments should reac the above office prior to June 10, 1977, or suc other date that may be published in the Feder Register.

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VOLUME 2

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Note:

Visuals 2-6 of the "Proposed Sale Area Visuals" were prepared in conjunction with the Environmental Statement for OCS Lease Sale No. 47, but the information depicted thereon is still current.

Section I

Description of the Proposal

U S DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BLM
NEW ORLEANS OCS

A. Proposed Action

The proposed lease sale under consideration in this draft environmental impact statement includes 120 tracts offshore Texas and Louisiana (Figure I-1). Tracts are summarized by location, expected type of production, acreage, distance from shore and water depth in Appendix A. These tracts, if all leased would add approximately 235,874 hectares (582,856 acres), an increase of about 7%, to the current total of 3.5 million ha or 8.3 million acres (as of December, 1976) under Federal lease in the Gulf of Mexico. The tracts in this proposed sale range from 4 m to 183 m in water depth and from 5 to 293 km from shore (Visual No. 1). Sixty-two percent of the tracts offered are gas prone, and thirty-eight percent are oil and gas prone. This proposed lease sale would be held under Section 8 of the Outer Continental Shelf Lands Act (76 Stat., 462; U.S.C. Sec. 1337) and regulations issued under that Statute.

B. Activities Resulting from This Proposal

1. Scope of Development

The U.S. Geological Survey (USGS) estimated undiscovered, recoverable resources which could be developed as a result of this proposed sale amount to 75 to 150 million barrels of oil and 1.5 to 2.5 trillion cubic feet of gas. This would require an estimated 150 to 400 wells, 20 to 35 platforms and require approximately 161 to 282 km (100 to 175 miles) of pipelines. No pipelines are projected to be brought ashore as a result of this proposed sale unless production results in an area remote from existing facilities. It is estimated that the proposed leases may produce 10,000 to 25,000 barrels of oil per day and 300 to 500 million cubic feet of gas per day when peak production is reached. After consultation with industry representatives and the U.S. Geological Survey, it is not anticipated that any barging of production from offshore sites to onshore receiving facilities will occur as a result of this proposed sale.

The amount of commercial activity that may be generated in the Gulf of Mexico region as a result of this proposal is dependent on many variables. Chief among these variables would be the availability of capital, manpower, equipment and the amount of proven recoverable reserves. Table I-1 summarizes the range of activities required to develop the estimated reserves within the proposed lease sale tracts (see also Tables I-2 and I-3).

2. Environmental Studies Program

There has been no site specific environmental study undertaken especially for proposed Sale 45, however, several BLM-funded scientific investigations are being conducted throughout the Gulf of Mexico Federal areas of OCS jurisdiction to obtain data that may be used in evaluation of this and future offshore leasing proposals (Table I-4). These are discussed below.

The BLM has established broad objectives for the environmental studies programs in order to satisfy various legislative requirements, including those of the Outer Continental Shelf Lands Act, the Submerged Lands Act and the National Environmental Policy Act. These objectives are: (1) The acquisition of information about the OCS environment that will enable the Department and the BLM to make better management decisions regarding the development of mineral resources on the Federal OCS; (2) the acquisition of information about the OCS environment which will enable the Department and the BLM to detect the impacts of OCS oil and gas exploration and development on the marine environment, and information which will enable the detection of environmental changes which may occur as a result of oil and gas operations; (3) the establishment of a basis for prediction of impact of OCS oil and gas activities in frontier areas; (4) the identification of sensitive habitats, potential geological hazards, and other factors of concern on the marine environment; and (5) the acquisition of impact data that may result in the modification of leasing stipulations, and OCS Operating Orders, Notices to Lessees, and guidelines permitting efficient resource recovery while also insuring the protection of the marine environment.

The first year of environmental studies programs included mapping and submersible reconnaissance of 16 topographic highs on the Texas OCS and has been completed. The reconnaissance allowed for visual (operators' reports, videotape and still photographs) characterization of these sites as potentially valuable resources (commercial fish havens, reefs or reef-type communities). Biological and geological sampling was also conducted. Much of this information was utilized in the promulgation of lease stipulations. In the second year further intensive submersible

TENTATIVE TRACTS FOR OCS SALE NO. 45

2/3/77

FIGURE I-1

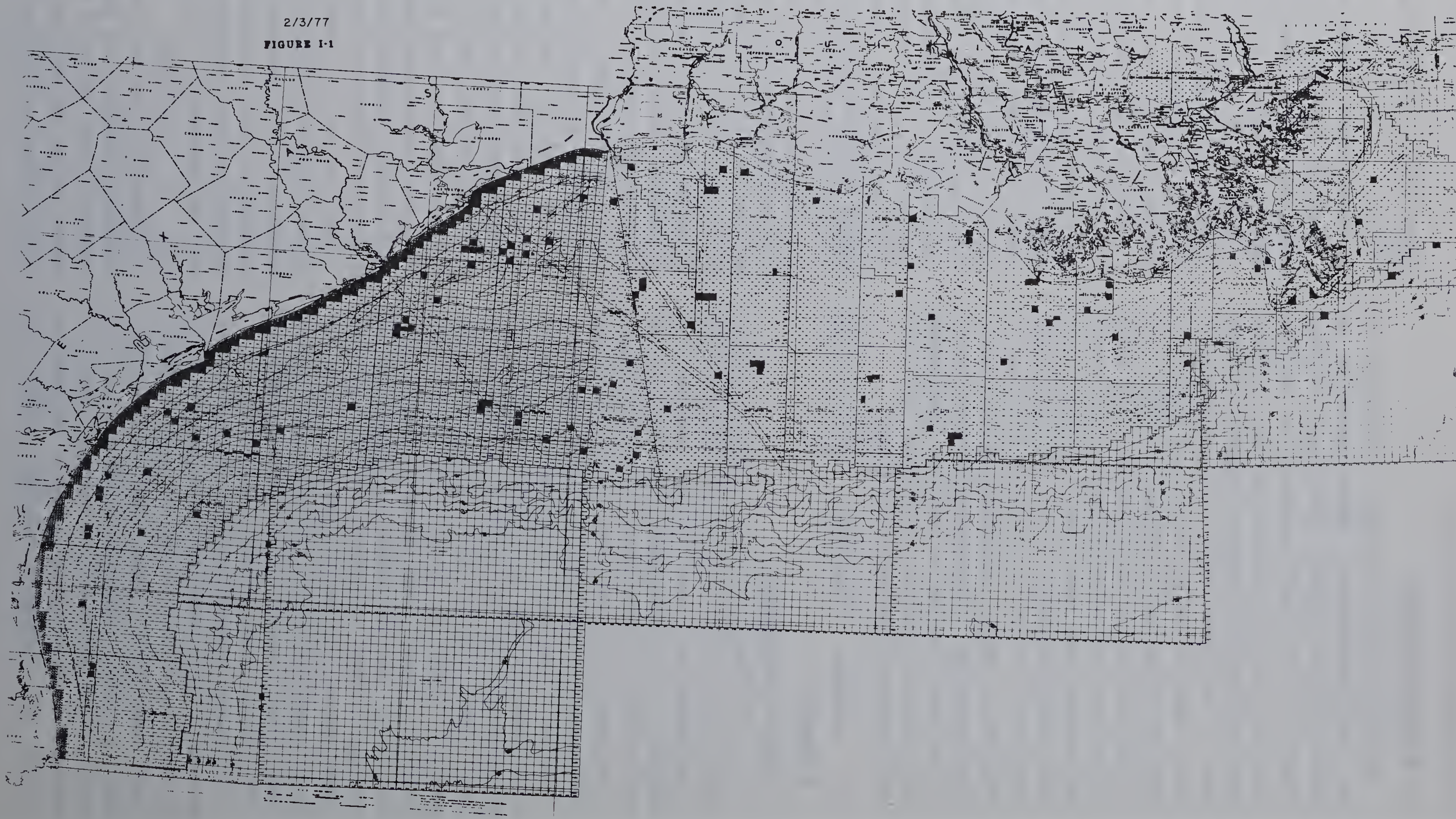


Table I-1. Summary of the range of activities required to develop the estimated resources within the proposed lease sale tracts.

	This proposed sale 1/
1. Estimated area, construction activity and resources:	
a. Hectares (millions)	235,874
b. Exploratory wells	50 - 100
c. Producing wells	100 - 250
d. Total wells	150 - 350
e. Platforms	20 - 35
f. Kilometers of pipelines	161 - 282
g. Terminal storage facilities	0 - 2
h. Estimated resources:	
Oil (million bbls.)	75 - 100
Gas (trillion cu. ft.)	1.5 - 2.5
2. Estimated annual crude oil transportation:	
Transported by tankers (bbls./yr.)	0
Transported by pipeline:	
Minimum estimate (million bbls./yr.)	3.7
Maximum estimate (million bbls./yr.)	9.1
3. Estimated volume of commercial mud and drill cuttings: Assume 350 wells with average depth of 10,000 feet. Cuttings: 682 tons per well: Mud components: 230 tons per well	
Drill cuttings (tons)	238,700
Mud components (tons)	80,500
4. Estimated volume of produced formation water proposed lease sale area: Assume 0.6 barrels formation water produced for each barrel of oil and condensate:	
Annual production (million bbls./yr.)	2.2 - 5.5
Total production (20 yrs.)(million bbls.)	45 - 60
5. Estimated total land use requirements for onshore facilities:	0 - 32 hectares
6. Estimated pipeline burial disturbance:	
Offshore: (where burial required) 4,921 - 9,841 cubic meters/kilometer will be disturbed.	792 - 2,775 2/
Onshore: a zone 9 - 12 meters wide along pipeline right-of-way will be disturbed.	0

1/ Estimated that approximately 35% of the acreage proposed for offering in this proposed sale will lease.

2/ Thousands of cubic meters

Table I-2. Proposed Lease Sale 45: Hypothetical Development Timetable; High Estimate

Year	Exploratory Wells	Platforms	Development Wells	Pipelines (miles)	Terminals
0					
1	5 - 15	0 - 1	2 - 5	0 - 15	
2	10 - 30	2 - 4	8 - 25	25 - 40	
3	20 - 60	5 - 10	25 - 60	25 - 40	
4	10 - 30	5 - 10	25 - 60	25 - 40	0 - 2
5+	5 - 15	8 - 10	40 - 100	25 - 40	
Total	50 - 150	20 - 35	100 - 250	100 - 175	0 - 2

Table I-3. The Expenditures Estimate to Result from Proposed Lease Sale 45 Range from Approximately $320 to $845 (million)

Expenditures	Low Estimate	High Estimate
1. Well drilling		
Exploratory wells	$100,000,000	$200,000,000
Development wells	$100,000,000	$300,000,000
Total Well Drilling Costs	$200,000,000	$500,000,000
2. Platforms	$100,000,000	$300,000,000
3. Pipelines	$ 15,000,000	$ 30,000,000
4. Terminal/Support Facilities	$ 5,000,000	$ 15,000,000
Totals	$320,000,000	$845,000,000

TABLE I-4. Status of BLM Environmental Studies in the Gulf of Mexico

Title	Contractor	Status
Gulf Bibliography - Socioeconomic & Environmental Baseline	Environmental Consultants, Inc.	Final Report Accepted
MAFLA (Mississippi-Alabama-Florida) OCS Baseline Study, FY'75	SUSIO (Florida State University System Institute of Oceanography)	Final Report Accepted
Gulf of Mexico Upper Continental Slope Ecological Study	TerEco, Inc.	Final Report Accepted
Hydrocarbon Analysis Quality Control Service, MAFLA and South Texas OCS Studies	University of New Orleans	Final Report Due June 1977
Eastern Gulf of Mexico Historical Physical Oceanography Data Synthesis	Gulf South Research Institute	Final Report Accepted
South Texas Topographic Features Study, FY'75	SUSIO	Final Report Accepted
South Texas OCS Baseline Study, Biology and Chemistry, FY'75	Texas A&M University	Final Report Accepted
South Texas OCS Baseline Study, Plankton, Fisheries, Physical, Oceanography, FY'75	University of Texas/Austin Texas A&M University Rice University	Final Report Accepted
South Texas OCS Baseline Study, Geology, FY'75	NOAA/NMFS	Final Report Accepted
Gulf of Mexico Pollutant Trajectory Modelling	USGS, Corpus Christi	Final Report Accepted
Multivariate Analysis of MAFLA Baseline Study Water Column Data	NOAA/AOMC	Final Report Submitted
MAFLA OCS Monitoring and Rig Monitoring	University of Florida Marine Laboratory	Final Report Accepted

TABLE I-4.(Continued)

Title	Contractor	Status
Gulf of Mexico OCS Cultural Resource Sensitivity Zone Mapping Study	Coastal Environments, Inc.	Final Report partially received
Benthic Organisms Hydrocarbon Analysis, MAFLA Baseline Study	University of Michigan	Final Report Accepted
Trace Metals Analysis Quality Control Service, MAFLA and South Texas OCS Studies	Gulf South Research Institute	Final Report Accepted
South Texas OCS Monitoring and Rig Monitoring Study, FY'76	University of Texas/Austin, Texas A&M University, Rice University, University of Texas/ San Antonio	Sampling Completed
South Texas Topographic Features Study, FY'76	Texas A&M University	Sampling Completed
Hydrocarbon Analysis Quality Control Service, All BLM OCS Studies	University of New Orleans	Analyses Underway
South Texas OCS Geologic Investigations Study, FY'76	USGS, Corpus Christi	Sampling Completed
South Texas OCS Fisheries Investigations Study, FY'76	NMFS	Sampling Completed
South Texas OCS Monitoring Study, FY'77	University of Texas Texas A&M University Rice University	Sampling Begun
South Texas Topographic Features Study, FY'77	Texas A&M University	Sampling Begun
South Texas OCS Fisheries Investigations Study, FY'77	NMFS	Sampling Begun
MAFLA Benchmark Studies	----	RFP issued

observations and standard oceanographic measurements were taken at Southern Bank and Hospital Rock. Bathymetric mapping has been completed for East Flower Garden, Stetson and an unnamed bank. Submersible reconnaissance has been conducted at the Stetson, East Flower Garden, Twenty-eight Fathom Bank and the adjacent unnamed bank. This work was conducted on this latter group of banks in order to precede anticipated drilling activity. In the third year, to commence this summer, bathymetric mapping will be completed for Three Hickey Rock, Bouma Bank, Parker Bank, 18 Fathom Lump, Ewing Bank, Sackett Bank, and one unnamed bank; submarine reconnaissance for biological and geological characterization of each bank will be performed. Additionally, seasonal monitoring studies will be initiated at the East Flower Garden Bank; these studies will be performed using submarine and scuba diving efforts and shipboard sampling.

A second recently completed special study entitled "Compilation and Summation of Historical and Existing Physical Oceanographic Data from the Eastern Gulf of Mexico" summarized available data of the Gulf of Mexico Loop Current, West Florida Shelf Currents, meteorological factors affecting the oceanographic conditions, river runoff effects in the MAFLA area, remote sensing data and the results of several drift bottle releases in the Gulf of Mexico. This information is and has been utilized in the planning and development of present and future studies in the MAFLA (Miss., Ala., & Fla.) area. In addition, it has provided substantive information on the evaluation of potential areas of impact.

A third special study, partially funded by the BLM, will attempt to develop the capacity to predict currents in the Gulf of Mexico for use in pollutant trajectory computations. This study is funded for a two-year period; it is now in its second year.

The National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce is conducting a study entitled "Environmental Assessment of an Arctic Oil Field in the Northwestern Gulf of Mexico, 1975-1978". Field collections are currently being taken. The results of this study will be of great interest to BLM.

The U.S. Fish and Wildlife Service also conducts studies pertinent to oil and gas operations on the OCS. The following ten studies are currently in progress:

1. "Analysis of onshore estuarine and marine effects of coastal and Outer Continental Shelf oil and gas development of fish and wildlife resources and coastal ecosystems". Final report due April 1977.
2. "Ecological characterization of the Chenier Plain of Southwestern Louisiana and Southeastern Texas". Pilot study due March 1977.
3. "Assess ecological and physiological effects of oil on birds." First Annual Report due January 1977.
4. "Colonial nesting and wading bird surveys for Northern Gulf of Mexico." Final report due March 1977.
5. "Development of methods and guidelines to protect fish and wildlife resources and supporting habitats during petroleum development activities on wildlife refuges of the Louisiana/Texas coast." Final product due August 1977.
6. "Biological impact of minor shoreline structures on the coastal environment." Final product due September 1977.
7. "Ecology, man's impact and management of seagrasses of the United States." Final product due July 1977.
8. "Geothermal development implications for Gulf Coastal Region." First quarterly report received.
9. "Endangered species of Southeastern Coastal Plain-sourcebook." Final produce due April 1, 1977.
10. "National Wetlands Inventory." U.S. Fish and Wildlife Service, National Wetlands Inventory Group. Mapping of wetlands begun.

C. Tract Selection Process

The tract selection process is one of the steps used by the Department of the Interior in attaining its objectives of orderly resource development, protection of the environment and receipt of fair market value.

Ordinarily, the proposed lease sale process begins with the Call for Nominations and Comments by the Secretary of the Interior, an invitation to industry to designate specific tracts on which it is interested in bidding if a sale is held, and to government agencies, private organizations, and individuals to nominate for various reasons areas they believe should not be leased (the so-called "negative nominations").

In the case of this proposed sale, the process began with the environmental briefing for representatives of the States of Texas and Louisiana on tracts identified by USGS and BLM as being potential for oil and/or gas production.

This procedure is authorized under Department of the Interior regulations which allow the Director of BLM, with the recommendation of the Director of the USGS, to select drainage, development, and special tracts without first calling for nominations and comments. Areas designated for the proposed lease sale include both "drainage" tracts—those which may share a producing oil and/or gas reservoir with adjacent tracts—and "development" tracts—those located on geological structures that have been known to contain oil and/or gas, plus wildcat tracts that had been previously rejected because of an inadequate bid in an earlier sale.

This type of sale is sometimes considered necessary for timely and orderly development in the well-established and highly developed OCS leasing areas of the Gulf of Mexico. There have been 12 such selections and sales over the last 20 years in the Gulf of Mexico.

A total of 120 tracts containing approximately 582,856.096 acres (235,882 hectares) have been identified for potential leasing under this tract selection process. Sixteen of these tracts, containing 67,311.20 acres (27,241 hectares) have been leased previously. Seventy of the tracts, containing 354,313.77 acres (143,391 hectares) have been offered previously and received bids, but were ultimately rejected.

D. Relationship of the Proposed Action to Existing and Prospective Offshore Oil and Gas Development in the Gulf of Mexico

This proposed action must be viewed as one part of a continuing activity that has been underway since the 1940's. Although primary emphasis concerning the description of the proposal and its potential environmental effects has been placed on this particular proposed sale in isolation from all previous activities of the same nature, it should also be put into the perspective of an ongoing offshore oil and gas development process. As of January, 1977 there have been 33 OCS oil and gas (and five OCS sulfur and salt) lease sales on submerged lands in Federal OCS areas of the Gulf of Mexico.

The Geological Survey has issued an approximate total of 2,122 pipeline permits on the OCS resulting in 2,824 kilometers of offshore pipelines. Currently, the Bureau of Land Management holds 414 permits on the OCS resulting in 8,462 km of offshore pipelines.

As production declines in existing areas (during the next 5-10 years), some of the equipment, transportation facilities, pipelines, platforms and personnel can be utilized in new areas of activity. As existing areas of production decline, the pipelines in place for that system can be used for new production areas, adjacent or farther from shore, thereby reducing the quantity of pipelines necessary to transport production from new areas to shore. The utilization of existing facilities and equipment could also result in a reduction in the quantity of onshore facilities estimated to be required for the transportation and processing of hydrocarbons that may be produced as a result of this proposed sale.

The proposed action is part of a program to accelerate oil and gas leasing on the Outer Continental Shelf. The proposed OCS Planning Schedule of June 1975 listed no additional OCS sales in the Gulf of Mexico. However, a revised OCS Planning Schedule was released by the Department of the Interior in January 1977 (Figure I-2). This new proposed schedule indicates possible future sales in the Gulf of Mexico OCS in late 1977, mid-1978, and in fall 1979 and 1980. These potential sales have been proposed and tentatively scheduled based upon the premise that future industrial interest could result from current exploration activities in the Gulf of Mexico as well as potential exploration activities that may occur should this proposed sale be held. As exploration proceeds the potential value of some tracts may increase.

The estimated oil production level that may result from this sale ranges from 10,000 to 25,000 barrels per day, or approximately 3.6 to 9.1 million barrels per year. Since production of oil and condensate from the Outer Continental Shelf adjacent to Louisiana declined by approximately 29 million barrels between 1974 and 1975, the crude oil and condensate production anticipated from Sale 45 can be considered to be a partial replacement for the decrease in OCS oil and gas production. This relationship suggests that a continuation of the effects of oil and gas related activity on other resources, rather than an increase in the ef-

FIGURE 1-2

PROPOSED OCS PLANNING SCHEDULE

January 1977
(Revises June 1975 Schedule)

1976

SALE AREA	J	A	S	O	N	D
44 Gulf of Mexico		F		N	S	
CI Cook Inlet		P			F	
47 Gulf of Mexico					E	P
42 North Atlantic				E		P
43 South Atlantic						
46 Kodiak						
45 Gulf of Mexico						
48 Southern California	C		D			
49 Mid-Atlantic					C	
Beaufort Sea (near shore)						
51 Gulf of Mexico						
53 General Pacific						
54 S. Atlantic Blake Plateau						
50 Beaufort Sea 2/						
55 Northern Gulf of Alaska						
52 North Atlantic						
56 South Atlantic						
58 Gulf of Mexico						
57 Bering - Norton						
59 Mid-Atlantic						
60 Bering Sea St George						
61 Cook Inlet						
62 Gulf of Mexico						
63 General Pacific						
64 Kodiak - Aleutian						

1977

SALE AREA	J	F	M	A	M	J	J	A	S	O	N	D
44 Gulf of Mexico												
CI Cook Inlet	N	S										
47 Gulf of Mexico		F	N	S								
42 North Atlantic			F		N	S						
43 South Atlantic		E		P		F		N	S			
46 Kodiak			E		P			F		N	S	
45 Gulf of Mexico	T			E		P			F		N	S
48 Southern California	T						E		P			F
49 Mid-Atlantic	D			T						E		P
Beaufort Sea (near shore)			State - Federal Sale									
51 Gulf of Mexico	C		D			T						E
53 General Pacific	C		D					T				
54 S. Atlantic Blake Plateau					C		D			T		
50 Beaufort Sea 2/							C		D			T
55 Northern Gulf of Alaska										C		D
52 North Atlantic											C	
56 South Atlantic												
58 Gulf of Mexico												
57 Bering - Norton												
59 Mid-Atlantic												
60 Bering Sea St George												
61 Cook Inlet												
62 Gulf of Mexico												
63 General Pacific												
64 Kodiak - Aleutian												

1978

SALE AREA	J	F	M	A	M	J	J	A	S	O	N	D
44 Gulf of Mexico												
CI Cook Inlet												
47 Gulf of Mexico												
42 North Atlantic												
43 South Atlantic												
46 Kodiak												
45 Gulf of Mexico												
48 Southern California		N	S									
49 Mid-Atlantic			F		N	S						
Beaufort Sea (near shore)		1/										
51 Gulf of Mexico		P			F		N	S				
53 General Pacific		E		P			F		N	S		
54 S. Atlantic Blake Plateau				E		P			F		N	S
50 Beaufort Sea 2/						E		P			F	
55 Northern Gulf of Alaska			T						E		P	
52 North Atlantic	D			T						E		P
56 South Atlantic		C		D			T					
58 Gulf of Mexico			C		D			T				
57 Bering - Norton					C		D			T		
59 Mid-Atlantic								C		D		
60 Bering Sea St George										C		D
61 Cook Inlet												
62 Gulf of Mexico												
63 General Pacific												
64 Kodiak - Aleutian												

1979

SALE AREA	J	F	M	A	M	J	J	A	S	O	N	D
44 Gulf of Mexico												
CI Cook Inlet												
47 Gulf of Mexico												
42 North Atlantic												
43 South Atlantic												
46 Kodiak												
45 Gulf of Mexico												
48 Southern California												
49 Mid-Atlantic												
Beaufort Sea (near shore)												
51 Gulf of Mexico												
53 General Pacific												
54 S. Atlantic Blake Plateau												
50 Beaufort Sea 2/	N	S										
55 Northern Gulf of Alaska		F		N	S							
52 North Atlantic			F		N	S						
56 South Atlantic	E		P			F		N	S			
58 Gulf of Mexico		E		P			F		N	S		
57 Bering - Norton				E		P			F		N	S
59 Mid-Atlantic	T						E		P			F
60 Bering Sea St George			T						E		P	
61 Cook Inlet	C		D			T						E
62 Gulf of Mexico		C		D			T					
63 General Pacific				C		D			T			
64 Kodiak - Aleutian					C		D			T		

1980

SALE AREA	J	F	M	A	M	J	J	A	S	O	N	D
44 Gulf of Mexico												
CI Cook Inlet												
47 Gulf of Mexico												
42 North Atlantic												
43 South Atlantic												
46 Kodiak												
45 Gulf of Mexico												
48 Southern California												
49 Mid-Atlantic												
Beaufort Sea (near shore)												
51 Gulf of Mexico												
53 General Pacific												
54 S. Atlantic Blake Plateau												
50 Beaufort Sea 2/												
55 Northern Gulf of Alaska												
52 North Atlantic												
56 South Atlantic												
58 Gulf of Mexico												
57 Bering - Norton												
59 Mid-Atlantic		N	S									
60 Bering Sea St George		F		N	S							
61 Cook Inlet		P			F		N	S				
62 Gulf of Mexico	E		P			F		N	S			
63 General Pacific			E		P			F		N	S	
64 Kodiak - Aleutian				E		P			F		N	S

Director, Bureau of Land Management

C - Call for Nominations
D - Nominations Due
T - Announcement of Tracts
E - Draft Environmental statement
P - Public Hearing
F - Final Environmental Statement
N - Notice of Sale
S - Sale

1/ State May Conduct Sale
2/ Within 60 Foot Isobath or Technology Capability

Sales are contingent upon technology being available for exploration and development. A decision whether to hold any of the lease sales listed will not be made until completion of all necessary studies of the environmental impact and the holding of public hearings; as a result of the environmental, technical, and economic studies employed in the decision making process, a decision may, in fact, be made not to hold any sale on this schedule.

INT: 1392-77

fects on these activities, is the most likely effect of proposed Sale 45.

If the potential value of presently unleased acreage should be enhanced by operations on tracts leased during proposed Sale No. 45, the effect would be to maintain oil and gas operation activity, maintain peak activity levels, and generally extend the peak activity period and the time frame anticipated for this proposed sale. The number and amount of certain activities or substances introduced into the environment as a result of oil and gas activities would be additive in nature, such as number of platforms, drill cuttings disposed, and drilling muds released into the marine environment. Possibilities of oil spills resulting from blowouts would increase since blowout probabilities are a function of the number of wells, and amount of production.

Production from Gulf of Mexico sales represents a significant portion of the Nation's current oil and gas production. The effect of this proposed sale is seen as a continuation of the existing oil and gas production in the Gulf of Mexico region, and the possible continued use of existing facilities established in response to production developed from past onshore and offshore activities. Through January 1, 1975, approximately 15,500 wells had been drilled offshore in the Gulf of Mexico, including 3,997 exploratory wells and 11,503 development wells (API, Basic Petroleum Data Book, 1975).

Since economies of scale could be achieved in some areas, certain activities would not increase in number or amount proportional to the increase in acreage leased or minerals extracted as a result of this proposal. Onshore support bases and pipelines, depending on the timing and success of additional operations, might require only marginal augmentation.

E. Relationship to Other Governmental Programs

1. Federal

a. Administrative and Regulatory Responsibilities

As indicated in the Tract Selection Process section, leasing procedures and pre-leasing evaluations and analyses are the responsibility of the Department of the Interior—primarily the Bureau of Land Management and the U.S. Geological Survey. The U.S. Fish and Wildlife Service helps design environmental studies and acts in an advisory capacity through much of the leasing process.

Several agencies, including Interior agencies, are involved in regulatory aspects of offshore oil and gas operations which involve their program areas. Offshore structures require permits to assure that navigation is unobstructed by ascertaining that structures are properly marked to protect navigation. These permits are issued by the Department of Defense, Secretary of the Army (Corps of Engineers) and the Department of Transportation (Coast Guard), respectively. Establishment and enforcement of navigational safety regulations is also a responsibility of the Coast Guard. Pipeline safety is regulated by the Materials Transportation Bureau (MTB) in the Department of Transportation.

In May 1976, the Secretary of the Interior and the Secretary of Transportation signed a Memorandum of Understanding (MOU) regarding pipeline safety regulations on the OCS. This MOU specifies each agency's individual responsibilities for pipeline safety supervisions and their joint responsibilities for inspection, enforcement, and coordination.

The U.S. Geological Survey has published 14 offshore oil and gas operating orders for the Gulf of Mexico, with one additional order currently under consideration. The existing orders and any future published orders will apply to all tracts which may be leased as a result of proposed Sale No. 45. These orders are reproduced in full in Appendix B.

The U.S. Geological Survey also considers safety features of design specifications in approving pipeline applications. BLM grants rights-of-way for pipelines through the Federal OCS.

The Federal Power Commission (FPC) and the Interstate Commerce Commission (ICC) regulate pipelines linked to interstate commerce, and the FPC sets the wellhead price of OCS-produced gas.

Operators must comply with requirements of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 466; 86 Stat. 816) which establishes a National Pollutant Discharge Elimination System, 40 CFR Part 125, 38 Federal Register 13528. Interim standards limit discharge to 30 MG/L average not to exceed 52 mg/L on any one day. This system applies to discharges from any point source and requires a permit from the Environmental Protection Agency for the discharge of any pollutant as defined by the Act. Discharges of pollutants without the necessary permit from EPA are unlawful. In accordance with the same Act, the U.S. Coast Guard approves the procedures followed and the equipment used for the transfer of oil from vessel to vessel and between onshore and offshore facilities and vessels. The Geological Survey performs surveillances for oil spills and discharges along the routes of pipelines from shore to the offshore facilities. The Coast Guard conducts pollution surveillance patrols to detect oil discharges within territorial and contiguous waters.

The FWPCA also provides for a National Oil and Hazardous Substances Pollution Contingency Plan for EPA, and the Departments of the Interior, Transportation, and Defense all share responsibility.

In addition, an OCS Advisory Board has been established pursuant to the provisions of the Federal Advisory Committee Act and under the authority of the OCS Lands Act of 1953. The objective of the Board is to advise the Department of the Interior in the performance of discretionary functions under the OCS Lands Act. These functions include all aspects of exploration and development of OCS resources, for example, resource evaluation, environmental assessment, leasing, mitigating of adverse impacts, and development plans. In formulating recommendations the Advisory Board shall, as applicable, request advice from the OCS Environmental Studies Committee.

The Advisory Board is chaired by the Secretary of the Interior or his designee and membership consists of one representative from the following: Department of State, Environmental Protection Agency, Federal Energy Administration, Council on Environmental Quality, and the U.S. Departments of Commerce, Defense, and Transportation. In addition, one representative from each of the 22 coastal States and Pennsylvania are members of the Advisory Board.

The OCS Environmental Studies Committee was created pursuant to the provisions of the Federal Advisory Committee Act and under the authority of the OCS Lands Act. This Committee advises the Department of the Interior on the design and implementation of studies related to oil and gas exploration and development on the OCS. These studies include baseline or benchmark data collection, evaluation, monitoring and special studies. The Committee will serve as the scientific counterpart of the OCS Advisory Board.

The Committee is chaired by a Department of the Interior scientist, designated by the Assistant Secretary, Land and Water Resources, and membership consists of one representative each from the Environmental Protection Agency, National Oceanic and Atmospheric Administration, National Science Foundation, the U.S. Coast Guard, U.S. Geological Survey, U.S. Fish and Wildlife Service, and the Bureau of Land Management. In addition, each of the 22 coastal states and Pennsylvania, similar to the Advisory Board, will have one appointed member on the committee. To achieve a balance of views the Secretary of the Interior can appoint not more than six scientists from the private sector to the committee.

B. OTHER FEDERAL ACTIVITIES ON THE GULF OF MEXICO OCS

Military Use

Principal military use of the Gulf of Mexico OCS is by the U.S. Navy. Gunnery, aircraft, missile, and submarine exercises and activities presently take place in this region under the jurisdiction of the Commander, Eastern Sea Frontier. Air National Guard exercises also take place in designated corridors over the OCS.

Deepwater Ports

Deepwater port proposals have been put forth for the Gulf of Mexico including one off the coast of Louisiana and another off the coast of Texas. The Department of Transportation, the responsible Federal agency, recently granted permits for Loop and Seadock.

Loop Inc., a consortium of six oil companies has proposed the construction of an offshore oil terminal to accommodate supertankers on the Louisiana OCS. They propose to place six single-point moorings in the Grand Isle area, blocks 52, 53, 58 and 59. The proposed lease tract nearest to this area is Tract 106 (Grand Isle area, Block 83) which is 11 km to the south.

Seadock Inc., has proposed construction of an offshore oil terminal to accommodate supertankers on the Texas OCS. The proposed terminal will be located in the Brazos area blocks 430 and 459 and Galveston area blocks 429 and 460. The proposed lease tract nearest to this area is Tract 33 (Galveston area, Block 420) approximately 5 km northeast of the proposed site.

It has been suggested that oil and/or gas from the OCS might be transported to shore through the same pipeline(s) serving a deepwater port. There is no provision for this in existing legislation, and as yet it is unclear whether this would be possible. Existing legislation is administered by the Department of Transportation.

More information regarding deepwater ports may be found in the Department of the Interior's Environmental Impact Statement on Deepwater Ports issued June 1973.

Ocean Dumping

The use of designated or interim ocean dumpsites will continue through the beginning of the next decade at which time EPA plans to phase out this practice. Given the anticipated level and timing of OCS related operations, ocean dumping would be occurring during the exploration and development phases of this proposed lease sale.

2. State and Local

The Governors of all of the coastal states are represented on the OCS Advisory Board. Following are discussions of State and local programs and legislation which have a significant effect, or will be affected by OCS activities.

a. COASTAL ZONE MANAGEMENT

The Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. 1451-1464), administered by the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, provides grants-in-aid to States for the development and implementation of management programs to control land and water uses in the coastal zone.

Amendments to the CZMA were adopted in July 1976 providing that states which are preparing a management program under Sec. 305 of the Act may receive supplementary grants and loans to deal with coastal zone impacts of OCS and other energy developments.

The CZMA requires that Federal actions within the coastal zone must generally be consistent with a state's CZM program once that program has been approved by the Secretary of Commerce. Conversely, state CZM plans must consider the national interest in facility siting. Local governments in turn must consider state and regional interests in the exercise of their coastal regulatory powers.

The states adjacent to the proposed sale area, Texas and Louisiana have both received CZM planning grants and supplemental OCS impact planning grants prior to the passage of the 1976 CZMA Amendments. Neither has as yet submitted a final plan to the Secretary of Commerce for approval, but both have received their third year CZM planning grants. At their present stages of development, neither plan envisages any additional restrictions on activities which would result from this proposed sale.

b. STATE LEGISLATION

Texas has enacted many laws providing for the management and protection of its coastal resources. These are set forth in the second edition of Texas Coastal Legislation prepared by the Texas Coastal and Marine Council (October 1975). Several of these are specifically energy related.

The Texas Deepwater Port Procedures Act of 1975 is designed to establish the procedures by which state and local agencies determine that applications for deepwater ports off the Texas Gulf Coast are in compliance with applicable State and local laws. This Act meets the State's responsibilities under the Deepwater Port Act of 1974 and specifically requires that all applicants comply with State laws relating to environmental protection, land and water use, and coastal zone management. It details the conditions under which the State of Texas will grant pipeline rights-of-way for oil and gas going to onshore storage, as well as easements on State lands for pumping and storage facilities.

In addition, Texas has enacted the Energy Policy Planning Act of 1975. It created the Governor's Energy Advisory Council. Its declared policy is that the future energy prospects portend such grave consequences for the economy and environment of Texas that all State government policies and actions must be taken in accordance with an articulated State energy policy.

The Council is directed, among other matters to monitor and review existing and proposed actions and policies of all State and Federal agencies to determine the energy impact and to recommend possible alternatives more consistent with the State energy policy. In so doing, the Council is directed to maintain a public awareness of the probable impact of existing and proposed energy-related action by State or Federal Governmental bodies and must review and comment on existing and proposed action by the Federal Government.

In 1970, Louisiana enacted the Natural and Scenic Rivers System Act. Its provisions hold that in all planning which might affect such rivers or related lands consideration be given to potential natural and scenic river areas. Further, State agencies are forbidden to concur in plans of Federal agencies which would detrimentally affect a natural or scenic river.

c. Marine Fisheries Management

The Fishery Conservation and Management Act of 1976 (P.L. 94-265) established a 200-mile fisheries conservation zone off the coasts of the United States and its possessions, effective March 1, 1977. The Act provides for creation of Regional Councils to be composed of fishermen and individuals, representatives of States, and Federal interests responsible and concerned for commercial and recreational fisheries in the marine environment. Administered under the Department of Commerce, the National Marine Fisheries Service will assist the Regional Councils in developing fishery management plans inclusive of the Outer Continental Shelf. The Gulf of Mexico Fishery Management Council will develop the fisheries plan for the marine environment corresponding to the offshore area under study for proposed Sale 45. This plan will serve as a basis for policy and management decisions relating to fisheries in the Gulf of Mexico.

F. Legal and Administrative Background

In 1953, the Outer Continental Shelf (OCS) Lands Act (67 Stat. 462; 43 U.S.C. Sec. 1337) established Federal jurisdiction over the submerged lands of the continental shelf seaward of the state boundaries. The Act charged the Secretary of the Interior with the responsibility for the administration of the mineral exploration and development on the OCS. It also empowered the Secretary to formulate regulations so that the provisions of the Act might be met.

Subsequent to the passage of the OCS Lands Act of 1953, the Secretary of the Interior designated the Bureau of Land Management (BLM) as the administrative agency for leasing of submerged Federal lands, and the U.S. Geological Survey (USGS) for supervising operations on the OCS. The Department formulated three major goals for the comprehensive management program for marine minerals. These are (1) The orderly development of the marine mineral resources to meet the energy demands of the nation, (2) The protection of the marine and coastal environment, (3) The receipt of a fair return for the leased minerals resources. These leasing objectives are based on legislative mandates as explained below.

(1) Orderly resource development is based on the OCS Lands Act which give the Secretary the authority, in order to meet the nation's demand for oil and gas, to grant leases to the highest qualified bidder(s) on the basis of sealed competitive bids. (2) Protection of the marine and coastal environment is a direct outgrowth of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). This act requires that all Federal agencies shall utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences in any planning and decision-making which may have an impact on man's environment. The products of BLM efforts in this direction are Environmental Impact Statements (EIS), Environmental Assessment Staffs and contract studies designed to identify and characterize different types of environments and the problems they face. (3) Receipt of fair return has its base in two separate mandates. United States Code 31, Sec. 483(a) obligates the Federal Government to obtain a fair return for public lands that are sold or leased. This is further implemented within the Executive Branch by the Office of Management and Budget Circular A-25.

G. Development of Proposed OCS Planning Schedules

Proposed OCS planning schedules are developed in order to project the timing, size and location of specific lease sales for an OCS leasing program. General sale areas are identified and, at a later date, tentative acreage figures are established through the tract selection process for each proposed sale on the basis of broad resource knowledge and environmental evaluation. The goal of the proposed schedule is to provide for orderly development of OCS oil and gas resources and to maintain an adequate contribution of OCS production to the national supply.

In developing a proposed OCS planning schedule, the Department considers the three leasing objectives that have been set for the Departmental OCS program. These objectives are: orderly and timely resource development, protection of the environment, and receipt of fair return for leased mineral resources. The principal factor in planning for OCS leasing is to strive for a supply of oil and natural gas adequate to meet the demand for these resources, consistent with the protection of environmental values. This is the basis for the existence of the OCS leasing program. The tentative acreage selection process that follows must consider the need to balance supply with demand. Acreage is tentatively selected in sufficient amount to engender industry interest and promote a fair market return.

The proposed OCS planning schedule is essential as a program planning document to enable the Department to proceed in an orderly and timely fashion with its process of considering the several proposed and possible lease sales identified in that document. The proposed OCS planning schedule aids the Department of the Interior in establishing the order in which areas will be examined and in planning the work assignments of personnel and the allocation of resources for the environmental and other studies enumerated. The proposed OCS planning schedule also serves to apprise Federal, State, and local agencies, industry, and interested members of the public of the time frame for consideration of potential leasing in the identified areas of the OCS. The proposed OCS planning schedule is a flexible document that is subject to revision at any time. More particularly, the consideration of any proposed or possible sale is subject to being modified, deferred, or advanced.

In May 1974, the Department announced that it would prepare a draft environmental impact statement on the proposed program to accelerate OCS oil and gas leasing from three to ten million acres (1.2 to 4 million hectares) in 1975. This proposal considered the entire United States' Outer Continental Shelf. A draft environmental impact statement on this proposed program was published in October 1974, submitted to CEQ and made available to the public for review and comment. Public hearings were held in February 1975 on the draft statement in Anchorage, Alaska, Beverly Hills, California; and Trenton, New Jersey.

In November 1974, the Department modified the goal of its proposed accelerated OCS oil and gas leasing program nationwide from leasing 10 million acres (four million hectares) in 1975 to holding six proposed lease sales in 1975 (a proposed sale, as used herein, refers to a tentative sale for which tract selections have been made for the purpose of preparing a site-specific environmental impact statement), and six possible lease sales per year for the period 1976 through 1978 (a possible lease sale, as used herein, refers to a tentative sale which has been listed on a proposed planning schedule, but has not reached the tract selection stage of the consideration process), offering prospects in each frontier area by the end of 1978 (frontier area refers to any of the 17 recognized OCS areas in which there has been no prior Federal oil and gas leasing). Accelerated leasing remains an integral part of the proposal, but the specific acreage figure was eliminated.

The Department revised the content of the draft programmatic environmental impact statement in light of the written comments received on that statement and oral comments submitted at the public hearing held in February 1975. The final OCS programmatic EIS addressed the proposed program as modified in November 1974, and included a discussion and analysis of the proposed OCS planning schedule, revised in January 1977. The final statement was submitted to CEQ and made available to Federal, State, and local agencies and interested members of the public in July 1975. In September 1975, the Department approved a program to accelerate oil and gas leasing on the Outer Continental Shelf. The Department's decision was made only after conducting in-depth studies based on the best information available considering environmental, technical and economic aspects of the proposal to accelerate OCS leasing.

On November 14, 1974, a proposed OCS planning schedule was announced by the Department of the Interior at a conference with coastal States' Governors. This schedule reflected the proposed accelerated leasing program. The November 1974 proposed schedule was revised in June 1975 to indicate changes in timeframes concerning possible or potential sales. Most recently, in January 1977 the Department of the Interior released a modified new Proposed OCS Planning Schedule (Figure I-2) which: (1) reflects changes in the timetables for consideration of certain possible sales; (2) adds new possible sales for consideration in the Gulf of Mexico; and (3) deletes from consideration during the period covered (through 1980) certain possible sales previously shown in the June 1975 version. This new January 1977 proposed OCS planning schedule is based upon comments and review by coastal States, together with environmental value, demand for petroleum resources, resource potential and industry interest to develop the resources.

This proposed OCS planning schedule does not represent a decision to lease in any of these particular areas. It represents the Department's intent to consider leasing in such areas and to proceed with the leasing and development of such areas if it should be determined that leasing and development would be environmentally, technically, and economically acceptable.

As in the case of this proposed OCS oil and gas lease Sale No. 45, the Department has committed itself to prepare a site-specific draft environmental impact statement for each OCS oil and gas lease sale that may be proposed. This is in addition to the final programmatic EIS and the approval of the accelerated OCS oil and gas leasing program.

The approved accelerated leasing program that includes proposed sales in the Gulf of Mexico does not constitute a decision on this proposed lease sale. This site-specific proposal will be considered on an individual basis after the waiting period for the final site-specific EIS has expired, and only after the Department has considered the environmental, technical, and economic aspects of this particular lease sale proposal.

In the planning of the accelerated leasing program, a request for comments from all concerned parties on potential OCS oil and gas leasing appeared in the Federal Register in February 1974. The Bureau of Land Management and the Geological Survey reviewed all the responses received and, on the basis of these responses, determined several rankings of the 17 OCS areas, including the Gulf of Mexico, which were delineated in the request. The Central Gulf of Mexico was ranked first in a composite ranking of resource potential and preference. Four petroleum companies also ranked the 17 areas on the basis of environmental hazard. From least to greatest hazard, on a scale on one to ten (ten being greatest hazard), the Central Gulf of Mexico was ranked second.

This request for comments and ranking procedures was the first tier in the two-tier nomination system for OCS leasing, the second procedure being the tract selection process.

The Department has made several changes in the OCS oil and gas leasing program since the approval of the accelerated leasing program. Among these changes are the enactment of a ban on joint bidding among major oil companies; the establishment of the OCS Advisory Board, discussed in Section I.E., the sponsoring and funding of the OCS Environmental Studies Program, discussed in Section I.B., the issuance of final regulations for State involvement in OCS development decisions (30 CFR 250.34); and the issuance of final regulations for geological and geophysical exploration of the Outer Continental Shelf (30 CFR 251).

The regulation banning joint bidding among major oil companies producing more than 1.6 million barrels a day worldwide of crude oil, natural gas, and liquefied petroleum products was initially published in the Federal Register pursuant to the 43 CFR 3300 regulations on October 1, 1975. A list of these major oil companies is prepared and announced in the Federal Register every six months for the bidding period of November 1 through April 30 and May 1 through October 31. Presently nine companies are banned from bidding together on OCS leases. No restrictions, however, are imposed on any of these companies for bidding jointly with another company having a daily production of less than 1.6 million barrels worldwide.

The modification of the 30 CFR 250.34 regulations was finalized in November 1975. This modification requires State review and participation in the development phase of OCS activities. The development plan prepared by the lessee must be reviewed by the Governor or his designee of each directly affected State, as discussed later in Section IV.

The issuance of final regulations concerning geological and geophysical exploration of the Outer Continental Shelf (30 CFR 251) was published in the Federal Register on June 23, 1976 (41 F.R. 25891-25897). These regulations prescribe the policies and procedures under which permits may be issued to persons or agencies to conduct such exploration on the OCS, as well as the procedures regarding public availability of data and information from the test records.

Section II

Description of the Environment

U S DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

BLM
NEW ORLEANS OCS

A. Geologic Framework

1. General Geology

Comprehensive discussions of the geologic framework of this region can be found in past Environmental Impact Statements:

For Offshore Louisiana, OCS Sale No. 33, FES 74-6, Vol. 1, pp. 101-122 (USDI, BLM 1974).
For East Texas, OCS Sale No. 34, FES 74-14, Vol. 1 pp. 49-61 (USDI, BLM 1974).
For Louisiana, OCS Sale No. 36, FES 74-41, Vol. 1, pp. 55-83 (USDI, BLM 1974).
For Offshore Texas, OCS Sale No. 37, FES 74-63, Vol. 1, pp. 61-94 (USDI, BLM 1975).
For Offshore Central Gulf, OCS Sale No. 38, FES 75-37, Vol. 1, pp. 13-12 (USDI, BLM 1975).
For Gulf of Mexico, OCS Sale No. 41, Vol. 1, pp. 16-57 (USDI, BLM 1976).
For Gulf of Mexico, OCS Sale No. 44, Vol. 1, pp. 1-13 (USDI, BLM 1976).
For Gulf of Mexico, OCS Sale No. 47, Vol. 1, pp. II-1-II-18 (USDI, BLM 1977).

The Gulf of Mexico presently represents a subsiding ocean basin partially filled with sediments. The abyssal Gulf is underlain by a simatic (oceanic type) crust. Domes and diapirs, anticlines and faulting in the western Gulf create the greatest geophysical interest from the petroleum standpoint. The occurrence of salt domes has led to the division of the northern Gulf continental shelf into two provinces. To the east of DeSoto Canyon (General Gulf, Visual No. 2) the shelf is composed largely of a thick sequence of carbonate deposits. Although salt domes occur in DeSoto Canyon, the general decrease in the number of domes east of the Mississippi Delta implies that the underlying salt deposits thin eastwardly. High areas in the basement rocks created a barrier to deposition and may have limited the extent of Jurassic salt deposition to the east along the northern Gulf (Antoine, 1972).

Subsidence, sedimentation and erosion have built the submarine topography as depicted in bathymetric maps of the Gulf by Holland (1970) which is the major source of the bathymetry shown on the series of visuals with this Environmental Impact Statement (EIS).

The continental shelf is a gently sloping submarine plain (less than 1°) of varying width forming part of the border of the continent out to a water depth of approximately 148 m, at which point the continental slope begins. The continental slope has a steeper gradient (approaching 5°), extending from the continental shelf to the oceanic depths.

The environment of deposition of the continental shelf sediments is most significant in its relationship to hydrocarbon production. Sediments deposited on the outer shelf and upper slope have the greatest potential for bearing hydrocarbons due to the following:

(1) This is the location where coarser, nearshore sands interfinger with the deeper-water marine shales, thus providing an optimum ratio of sandstone to shale. The shale forms the source-rock which provides the oil and gas and the sandstone provides the reservoir into which the hydrocarbons migrate.

(2) In this environment, the organic material deposited with the fine-grained clays and muds is preserved, and not oxidized as it might be in shallower, more turbulent water.

(3) It is at this location that the increased overburden of the prograding shallow marine deposits over the plastic salt and marine shales initiates salt flow which triggers the growth of salt domes and regional expansion faults thus providing traps for the hydrocarbons.

This environment, therefore, is the optimal one for providing the three ingredients for the successful formation and accumulation of oil and gas: reservoir rock, source beds and traps.

The continental slope in the northwestern Gulf consists of two parts, a relatively steep lower slope which breaks off abruptly along the Sigsbee Scarp and the upper slope (with 1-2° dip) which is characterized by a hummocky topography made up of small domes (seaknolls) and depressions. This upper slope occurs at about the 150 m bathymetric contour which delineates the Outer Continental Shelf-upper slope hinge line.

The structural grain and topography of the slope are controlled primarily by salt tectonics and the hummocks or hilly nature of the upper slope is due to diapiric salt structures. The top of the salt surface may be identified on seismic records as a weak reflector with a lack of bedding reflectors at depth. Seismic reflection profiles across the continental margin of Louisiana and Texas suggest that most of the topographic "highs" on the upper continental slope are probably associated with salt intrusions or shale diapirs.

2. Status of Geologic Mapping in the Gulf of Mexico Area

To gain a better understanding of the geology of the Gulf of Mexico several visual graphics were prepared at a scale of 1:1,000,000 UTM (Universal Transverse Mercator) from a considerable amount of published and unpublished information.

A comparison of salt dome locations and the production trends on Visual No. 2 with the lease status maps (Visual No. 1) will give an overview of areas of success, failure and future potential in the area of the proposed sale. An intercomparison of the bottom sediment (Visual No. 3), geology (Visual No. 2) and undersea features (Visual No. 4) will give the viewer information on the origin and location of fishing banks and unique areas. A comparison of undersea features with the lease status maps will show where prospective areas are in relation to areas requiring special stipulations.

The source of most available data on coastal Texas is the Bureau of Economic Geology, University of Texas. This group (see Bureau of Economic Geology Annual Reports 1972 thru 1976) has compiled environmental geologic maps at a scale of 1:24,000 for the seven coastal areas of Texas covering a strip of the coastal zone approximately 80 km wide. These maps include the areas from 16 to 24 km offshore and 56 to 64 km onshore. These maps are published as regional maps at a scale of 1:125,000.

The geologic information used for Visual No. 2 was taken from several generalized sources including:

Geologic Map of Louisiana by R. J. LeBlanc, 1948, unpublished.
Geologic Map Coastal Louisiana by D. E. Frazier, 1967.
Geologic Map of Mississippi by Miss. Geological Survey, 1969, prepared by Mercury Maps, Inc., Jackson, Miss.
Geologic Map of Baldwin County, Alabama, P. C. Reed, 1971, Bull. 106, Plate 4, University, Alabama.
Tectonic Map of Louisiana, Pl. II, Lafayette Geological Soc., 1973.
Production Trend Map Pl. I, Lafayette Geological Soc., 1973.
Production Trend Map of Gulf, USGS, Metairie, La. 1974.
Oil & Gas Map of Louisiana, La. Geological Survey, 1973, Baton Rouge, La.
AAPG Tectonic Map, Gulf Coast, 1972, Tulsa, Okla.
AAPG, U.S. Geological Highway Map Series - Southeastern Region, Alabama, Florida,
Georgia, Louisiana; Map No. 8, 1976, Tulsa, Okla.
GSA Bull. Vol. 83, Wilhelm & Ewing, 1972.
AAPG - U.S. Geological Highway Map (Texas), H. B. Renfro, 1973.
Offshore Louisiana Oil & Gas Fields, Lafayette Geological Survey, 1970.
AAPG Bathymetric Map, Gulf of Mexico, W. C. Holland, 1970.
Geologic Map of Louisiana, Busch et al., 1974.
Physiographic Overview of South Louisiana, 1972.
Atlas Inventory of Basic Environmental Data, U.S. Dept. of the Army, 1972.
Subsurface Fault and Salt Dome Map, Environmental Atlas for South Central Louisiana,
Gagliano et al., 1973, Rep. No. 18, Center for Wetlands Resources, LSU, Baton Rouge, La.
Geologic Map of Florida, Vernon and Puri, 1964.

It should be noted that Louisiana is particularly in need of a modern compilation of coastal geology. Busch et al. (1974) have compiled a physiographic map of the Atchafalaya Basin and a portion of the lower Red River Valley. Another study for south-central Louisiana is the U.S. Army Corps of Engineers-Sea Grant Study, by Gagliano et al (1973).

3. Geologic Hazards

A number of important geologic hazards occur in the offshore Gulf of Mexico. In the Texas offshore area the possibility of blowouts exist due to the presence of shallow gas deposits within the sediments. Deeper high pressure zones can also cause blowouts during the drilling operation. A third hazard is a soft plastic sea floor laced with surficial faults which can present unstable foundations for rigs. A fourth hazard can occur in rough sea floor conditions where coral heads, sharp reefs and structural troughs occur. Damage to the rig in areas of poorly described roughness can occur by jamming the legs or having legs slip off rough surfaces. The problem of locating rigs on a soft plastic sea floor is compounded in offshore Louisiana along the steeper slopes of the Mississippi River delta primarily off Main, South and Southwest Passes (Fig. II-1).

a. Subsidence

The apparent rise in sea level and/or land subsidence is a hazard along the low coastal lands of Texas and Louisiana.

Along the coastal lands subsidence cannot easily be separated from the effects of the rise in sea level because either action allows encroachment of the ocean. Causes of the rise in sea level are generally attributed to the melting of glaciers and polar icecaps.

Land subsidence is generally attributed to extensive pumping of ground water and petroleum which causes a decline in the piezometric pressure in the porous rocks allowing once saturated beds to compress. Subsidence can also occur

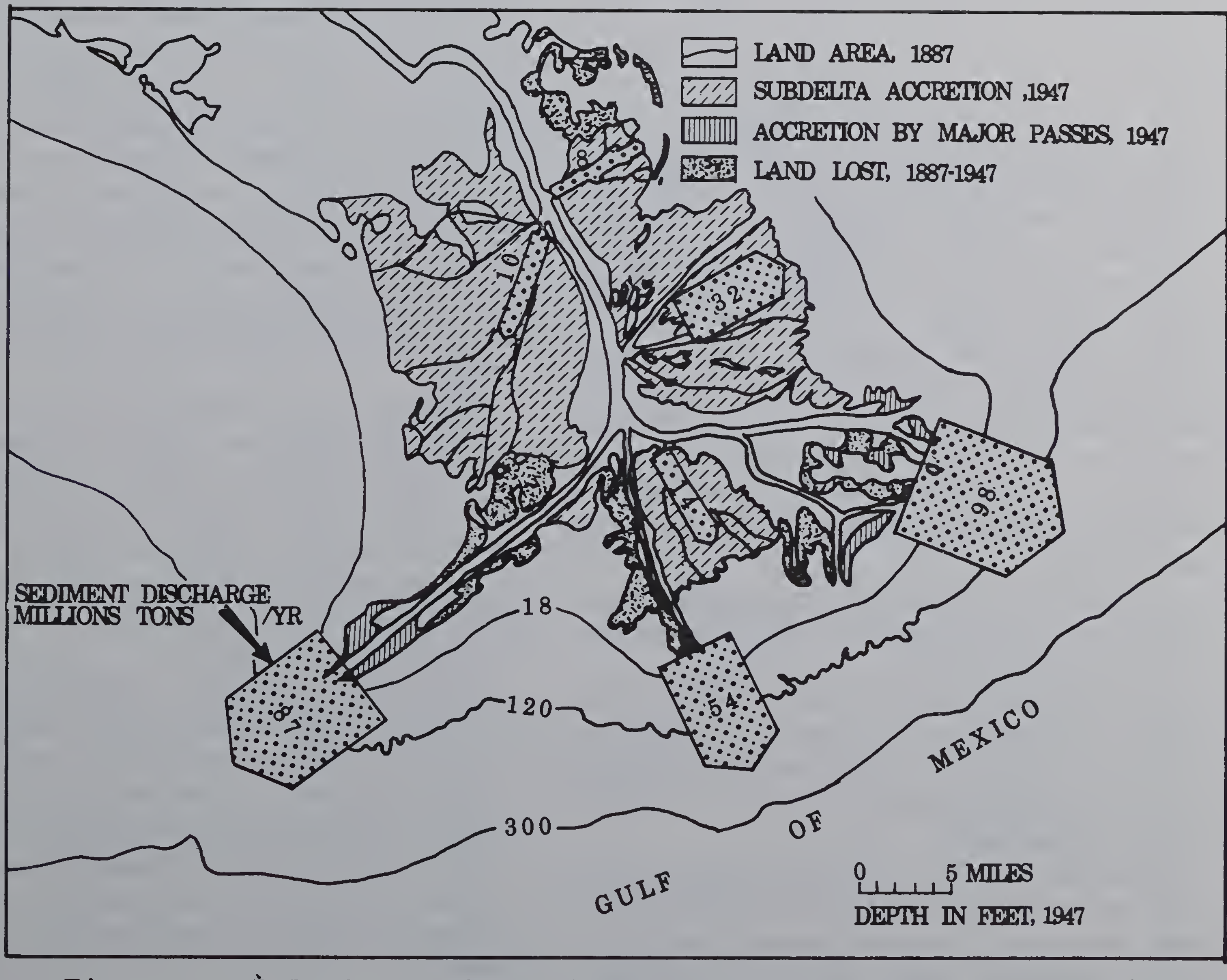


Figure II-1 Relative sediment discharge and land accretion in the active birdfoot delta of the Mississippi River.

SOURCE: GAGLIANO ET AL, 1971

from sand and sulphur pumping and tunnel mining; however, this is rare in the areas under consideration. Subsidence may also be stimulated by overburden compaction as a result of dredging waterways. Levee flank depressions are created that develop into open water bodies. These water bodies are another factor in land loss within South Louisiana.

National Ocean Survey (NOS-NOAA) has maintained tide gauges and sea level data in the Gulf for many years.

The pumping of large amounts of ground water in the Houston-Galveston region, Texas, has resulted in water-level declines of as much as 61 m in wells completed in the Chicot aquifer and as much as 99 m in wells completed in the Evangeline aquifer during 1943-73. The maximum average annual rates of decline of 1943-73 were 2.0 m in the Chicot aquifer and 3.3 m in the Evangeline aquifer. During 1964-73, the maximum rates were 3.0 m in the Chicot and 5.4 m in the Evangeline. The declines in artesian pressures have resulted in pronounced regional subsidence of the land surface.

The center of subsidence is at Pasadena, where as much as 2.3 m of subsidence occurred between 1943 and 1973 (Fig. II-2).

In the southern part of Harris County, about 55% of the subsidence is a result of compaction in the Chicot aquifer. The area with subsidence of 0.3 m or more was about 906 km² in 1973 and has increased since then.

Planned use of surface water instead of ground water will probably result in some recovery of artesian pressures. If pressure recovery occurs the rate of subsidence should decrease substantially in the more critical areas.

b. Mud Slides

Recent studies of mud slide hazards in the Mississippi Delta were conducted by the U.S. Geological Survey with the cooperation of the Coastal Studies Institute of Louisiana State University. Figure II-3 delineates areas where adverse foundation conditions can exist.

A report to BLM from the USGS entitled "Environmental Assessment of the South Texas OCS - Geologic Investigations" outlines the following conditions for the South Texas OCS (Fig. II-4).

Surficial and shallow subsurface sediments are typically fine grained and characteristically are soft rather than firm and compact. This softer sediment province might have a greater tendency for retention of industrial pollutants, as compared to a more permeable and aerated sandy province. The outer one-quarter of the Rio Grande Delta must be classed as a potentially mobile area; it is subject to future movement. Displacement of sediments by gravity sliding or slumping along the sea floor is restricted to the outer edge of the ancestral Rio Grande Delta. Within the South Texas study area, slumps of relatively large scale displacement are at the outer edge of the shelf coincident with the upper continental slope. Landward and adjacent to the area of active slumping is a belt of older slumped sediments now covered by underformed sediments. It has been possible to cope with some areas of unstable conditions through extensive engineering design on the platforms.

Relatively rapid sediment movement can occur both in the lateral and vertical directions placing a structure in critical trouble. These movements, which may cover larger areas, pose a type of hazard to sea floor structures which is analagous to that posed by landslides to structures onshore, except that offshore they may occur on slopes which are almost negligible.

Some of the pioneering work in this field by Shell Oil Company suggests that in some cases fluctuating pressures within the upper 32 m of sediment caused by storm waves may trigger a sediment failure. Other investigations conducted at the Coastal Studies Institute indicate that the content of dissolved and undissolved gases in sediments may play an important role in their instability.

c. Earthquakes

Of lesser importance in the Gulf of Mexico is the risk from earthquakes. No known damage has been recorded from earthquakes on an offshore oil platform or installation in the Gulf of Mexico.

Seismic risk areas were originally designated for all parts of the U.S. in 1947 by the U.S. Coast and Geodetic Survey and revised several times

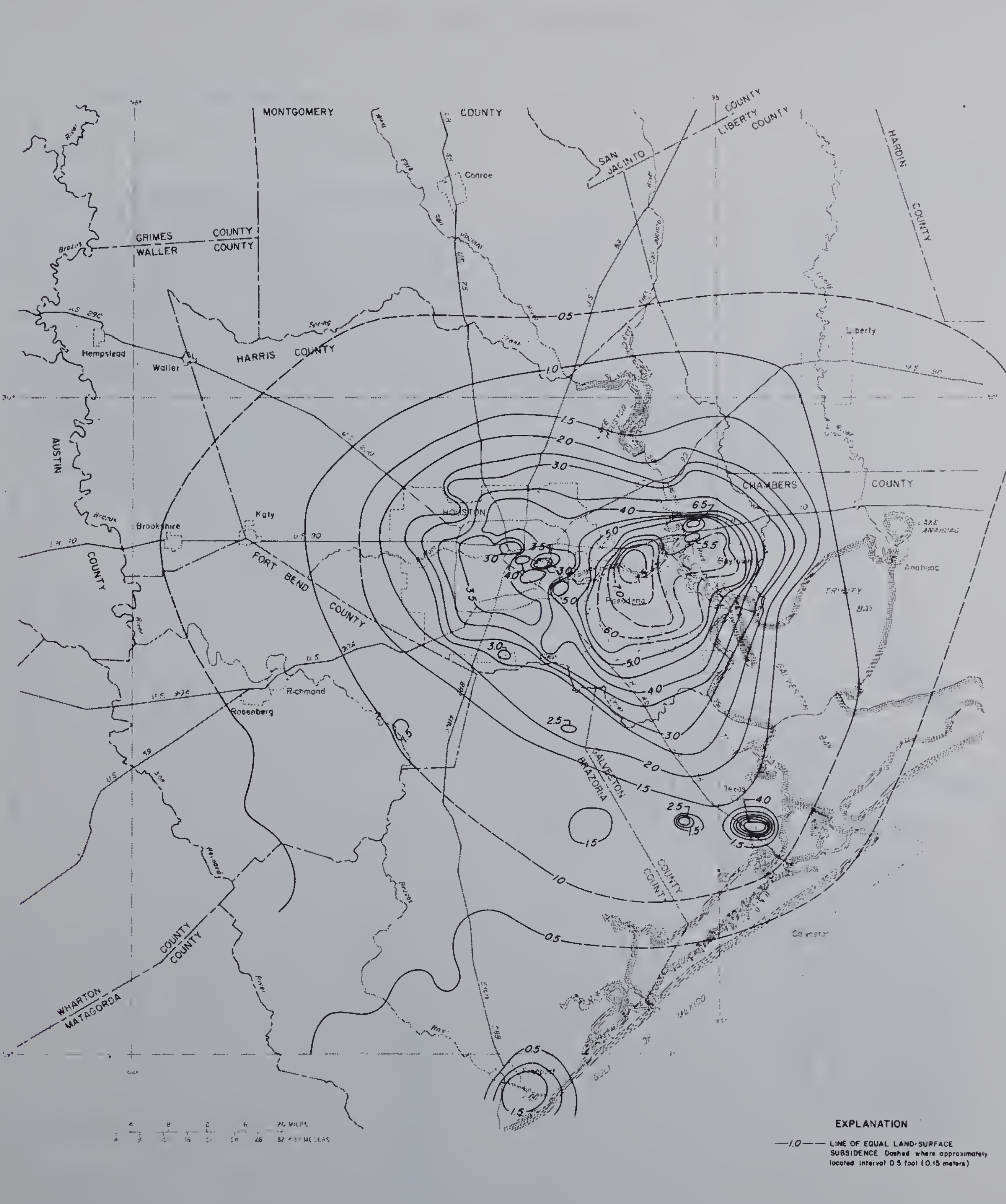


Figure II-2

Subsidence of the Land Surface, 1943-1973

AFTER R.K. GABRYSCH & C.W. BONNET, (1975).

FIG.II-3 MAP SHOWING ZONES OF RELATIVE BOTTOM SEDIMENT STABILITY. (U.S. GEOLOGICAL SURVEY, 1974.)

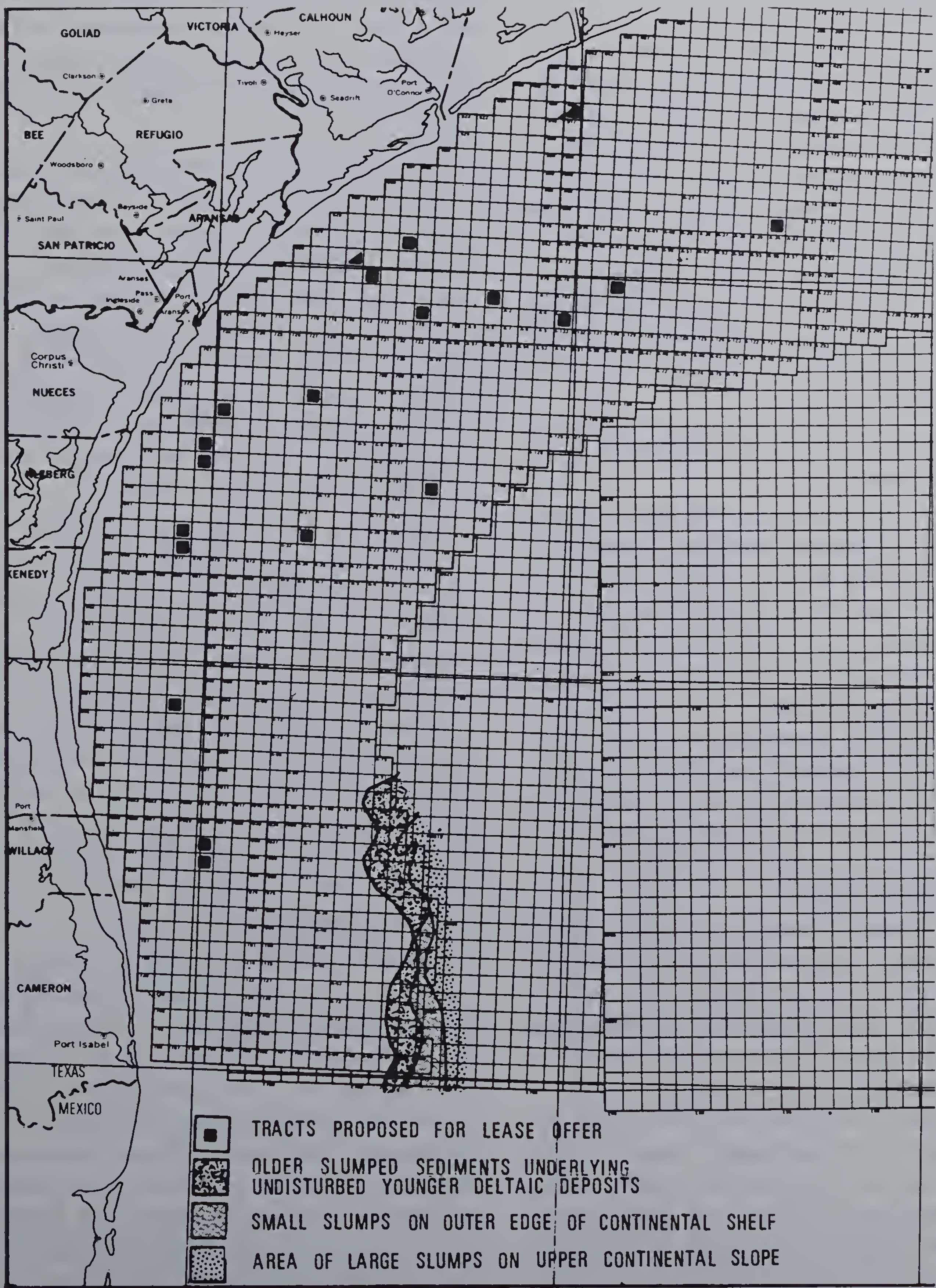


FIGURE II-4. AREAS OF SLUMPED SEA FLOOR SEDIMENTS.
FROM: SOUTH TEXAS OCS ENVIRONMENTAL STUDIES-GEOLOGY, USGS, 1975.

since then. Seismic risk is expressed in arbitrary numbers from 0 to 3. They are based on historical data considering only the intensity of an earthquake, not the frequency of occurrence, and express the anticipated damage that would occur in that area.

Zone 0 - No damage
Zone 1 - Minor damage
Zone 2 - Moderate damage
Zone 3 - Major damage

In the western Gulf of Mexico, seismic risk is zero (Algermissen and Perkins, 1976). This appears to be a rather unique area due to the lack of seismicity. No earthquakes of any notable intensity have been recorded for this area and only two earthquakes of notable intensity have occurred in the Gulf near this area; one north of Vera Cruz, Mexico and one southeast of the leasing area in over 600 m of water near 93° W and 27° 30′ N. Neither of these earthquakes produced damaging tsunamis and neither were considered well located events.

d. FAULT DISPLACEMENT, HYDROCARBON SEEPS AND SEEP MOUNDS

Active faults, gas seep areas and seep mounds pose dangers to offshore seabottom operations, however these hazards are some of the most obvious anomalies recorded by geophysical surveys for bottom hazards. Active faults in hydrocarbon producing areas such as the vast salt dome province in offshore Louisiana.

(Visual No. 2) are generally associated with hydrocarbon seeps (normally gas seeps) and unstable seep mound areas which can often grow to heights of more than 16 m. Areas underlain by salt domes, such as the Flower Garden Banks, Claypile and Stetson Banks.

(Visual Nos. 2 and 4) are typical areas where active faults, gas seeps and seep mounds have been surveyed. Since these features are notable on side-scan and high-resolution seismic data, these survey techniques are routinely used to locate these hazards.

The South Texas OCS study by the USGS has noted a number of plume-like traces, some parabolic and others more nearly straight lines, recorded on both the 3.5 Khz and mini-sparker acoustic profiles. Many of the plumes are directly above faults that either extend to the sea floor or lie at shallow depth beneath the sea floor, suggesting natural gas seepage (Fig. II-5).

Active fault displacements, gas seeps and seep mounds are generally considered an order of magnitude less hazardous than gas charged sediments and high pressure gas zones due to the recognizability of these former features on survey records. Gas charged sediments, high pressure gas zones and gas saturated sediments in delta areas are significant potential hazards, however. Although geophysical techniques cannot detect high pressure zones directly, processed survey data frequently reveal velocity and amplitude anomalies which appear to correlate with geopressured zones.

e. BATHYMETRIC PROMINENCES AND STEEP SLOPES

Rough sea floor conditions where coral growth, reef scarps and troughs occur can be hazardous to pipeline installations and installations of offshore platforms. Shipwrecks and large artificial reefs must also be avoided as obstructions in place as well as movable hazards if the area is disturbed by high currents and bottom instability during severe storms and hurricanes. These problem areas can be located by modern geophysical equipment used in hazard surveys.

f. RATING OF THE HAZARDS

It is not entirely realistic to rate hazards since they vary greatly in areal extent, magnitude, intensity, chance of occurrence and degree of mitigation. Each hazard must be studied on a case-by-case basis in each particular area.

During its review of applications to drill, the USGS informs the applicant of all current data concerning geologic hazards in the proposed area of operations, and requires that the applicant submit an operation plan which outlines procedures intended to deal with these hazards.

4. Bottom Sediments

Sedimentation in the Gulf of Mexico has been complicated by transgression and regression of the shoreline in response to changes in sea level and/or tectonic movement of the adjacent land mass or sea bed. The overall pattern of deposition is one of transgression interrupted by minor regressions. The result of this is a sequence of continental, deltaic or paralic, and shallow water sandstones, siltstones, and shales being progressively built out over marine deposits. At various times in the geologic past, particularly in the late Tertiary, sea level has been lowered or raised in response to increased or decreased glaciation.

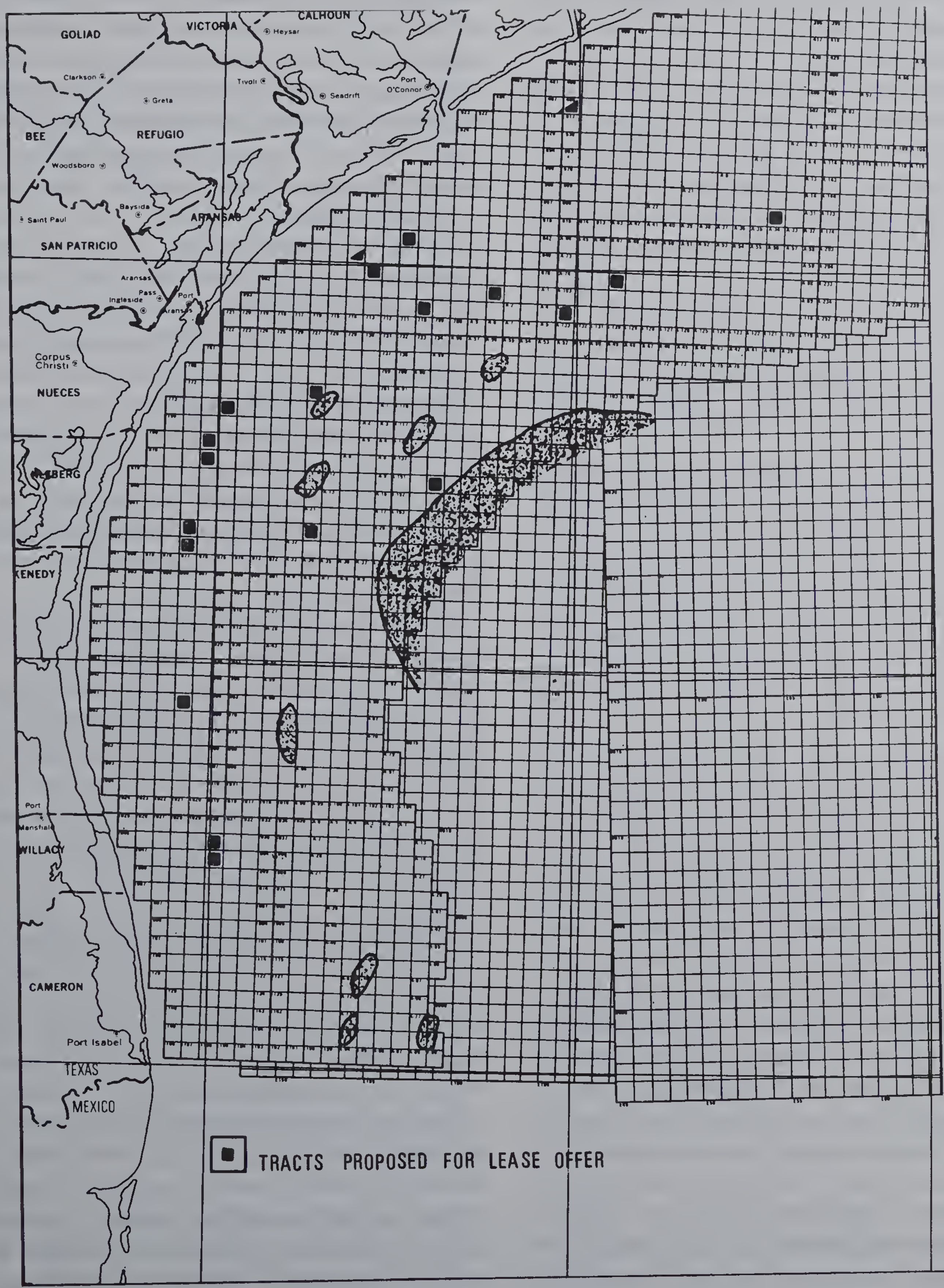


Figure II-5 General outline of areas where plumes suggesting scattered natural gas seepage were recorded on acoustic profiles.

From: South Texas OCS Environmental Studies-Geology, USGS 1975.

This has tended to upset the normal progradation of the shoreline, but at the same time it created extensive salt marsh areas on the now submerged continental shelf. Decay of buried organic matter from brackish water marshes are thought to be the primary source of the hydrocarbons found on the continental shelf.

The Mississippi Fan dominates the north central Gulf region of the Gulf of Mexico (Visual No. 2). This thick accumulation of primarily Quaternary alluvium extends over a 414,000 km^2 area including parts of the shelf, slope, rise and abyssal floor. Bottom gradients range from two degrees near the apex to about 0.3° at the outer margin more than 644 km to the southeast. Within this slope regime the greatest change in gradient occurs at the 2,500 m isobath and arbitrarily divides the fan into upper and lower segments (Huang and Goodell, 1970).

Historically, the site of active deltaic build-up along the Louisiana coast has shifted several times during the past million years. Kolb and van Lopik (1966) identified at least seven subdeltas of the Mississippi Delta complex. The river's modern "birds-foot" delta, the Balize Lobe, extends underwater almost to the continental slope and represents the uppermost part of the Mississippi Fan.

The Mississippi Fan and major portions of the abyssal plain and continental rise contain sediments that were transported in part by turbidity currents and in part deposited pelagically. Sediments in these areas have been derived from the northern and western shelves and slopes; however, the bulk has been derived from the Mississippi Delta. The midwestern and southwestern Gulf have sediments that are more pelagic in origin. Their carbonate content is high and is made up in major part by foraminifera tests. A low accumulation rate is assumed for this area based on the observed high degree of bioturbation.

The Alaminos, Old Mississippi and DeSoto Canyons are inactive canyons in which the upper part of the sediment column does not reveal typical submarine canyon characteristics but a rather homogeneous ooze type sediment as fillings.

Relief features associated with the shelf edge and slope have been reported by Uchupi (1967), and Bergantino (1971), (General Gulf, Visual No. 1).

Sediment maps for the Gulf of Mexico (Visual No. 3) have been compiled principally from a map by John Grady (1970), and the USGS "Environmental Studies of the South Texas OCS Geology" by Dr. Henry L. Berryhill, Jr., et al. USGS (1975). Additions to these data have been made principally in the location of hard banks, coral banks, gravel and shell areas taken from other sources such as commercial fishing bank maps, industry surveys and personal communications with university researchers, sports and commercial fishermen.

Localized sediment maps for the areas south of Timbalier Bay to Grand Isle (Gulf Universities' Research Consortium, 1974) and Mississippi Sound (from Eleuterius, 1974) contain detailed information useful as a supplement to the regional sediment map by Grady (1970).

According to Curray (1960) and Shepard (1960), the surface sediments of the shelf are mainly Holocene in age and are products of the marine transgression (depositions during the rise and fall of the sea level) following the Wisconsin glaciation.

Texturally, the South Texas sea floor is composed predominantly of mud. Quantitatively the highly dominant mud component is the silt fraction, which appears to be effectively trapped hydraulically within the OCS environment. In contrast, the subordinate clay fraction appears to reflect a more open dispersal system, with substantial clay detritus escaping into deeper environments. The majority of this OCS region can be classified as a clayey silt province. Sand detritus is quantitatively dominant within portions of the ancestral Brazos-Colorado and Rio Grande deltas. The gravel fraction is composed almost entirely of biogenic materials; it consists mainly of mulluscan shells, and occasional coral-algal reef debris in the vicinity of carbonate banks.

Textural variability is most pronounced in the ancestral delta regions of the northern and southern sectors, with transitions being most abrupt within the southern sector. Genetically, the textural variability indicated a composite fabric of modern, palimpsest (remant metamorphic structure), and relict sea floor deposits. The southern delta sector appears to be composed largely of relict Pleistocene-early Holocene deposits, which are characterized by relatively coarse textures, as well as high shell and heavy mineral concentrations; these sea floor sediments appear to be relatively immobile lag deposits which are in disequilibrium with modern hydraulic conditions. The variable deposits of the northern delta sector are also relatively coarse-textured; they appear to be composed largely of palimpsest or partially reworked sediments which are presently experiencing some net southward mass transport, thereby encroaching upon relict deposits of the southern ancestral delta. The influx of modern mud into the OCS region appears to reflect sediment contributions from multiple sources; the sources include coastal and shoreface erosion along the Padre Island barrier chain, suspended sediment effluent from adjacent estuaries, and possible *in situ* winnowing of relict and palimpsest deposits comprising the ancestral Rio Grande and Brazos-Colorado deltas.

Textural parameters exhibit consistent regional trends of increasing sediment coarseness shoreward, as well as both northward and southward from the central Texas sector. The trends reflect a composite response to both ancient and modern processes. Ancient processes are reflected by the presence of the relict and palimpsest deposits comprising the ancestral deltas. The trends further suggest that regional energy and residual southward-flowing coastwise currents are among the dominant hydraulic factors controlling the modern sediment dispersal system. Net seaward diffusive transport, in conjunction with net southward advective transport, appear to be prominent mechanisms of sedimentation with the Texas region. The color variability of sea floor deposits suggests varying degrees of oxidation, possibly attributable to varying of sedimentation within the Texas region.

Shallow subsurface sediments

The stratigraphic variability of the shallow upper Holocene deposits exposed in gravity cores indicates that the basic regional dispersal pattern exhibited by present sea floor sediments was initiated during earlier Holocene time. However, the relative proportions of sand and mud were different, with the sand facies being more widely distributed during the earlier Holocene. The cores illustrate a general westward displacement of the lithofacies pattern, thus indicating a stratigraphic overlap relationship developed during the late Holocene transgression.

The cores further suggest that the shallower, inner portion of the Texas OCS region is the sector most intensely affected by the storm hydraulic regime. Many discrete sand sedimentation units appear to reflect storm-generated deposits resulting from the seaward reflux of coastal waters following storm surges. Sand sedimentation units are most abundant in local areas adjacent to prominent coastal estuaries which appear to have been major sources of storm-reflux sediment.

A number of undersea features are shown in Visual Nos. 2 & 4. Many of these features are known to have unusual or notable sedimentary conditions and are generally regarded as preferred fishing areas or banks. Names of most of these features are of local use and have no official Federal acceptance. Visual No. 4 shows approximate locations of shipwrecks which could also have archaeological significance, as well as fish havens, fishing banks, rocks, holes and reefs. In the western Gulf of Mexico a striking number of banks are considered snapper and grouper fishing areas. These features usually prove to have been caused by the upward thrusting of piercement salt domes. The origin of East and West Flower Garden Banks is the joint growth of upward moving salt plugs and the reef building coral.

The bank which has been studied to the greatest extent is the West Flower Garden. A report "The Geology of the West Flower Garden Bank." by Edwards (1971), gives a complete history of studies there. A recent study by several investigators discussed the geology, geo-chemistry, sediment distribution and biology of a portion of the bank under the auspices of the Flower Garden Ocean Research Center (FGORC) during 1972. This study concentrated on the high part of the bank in the area of the living reef building coral. A wealth of excellent photographs and valuable data was collected during these research missions by Bright and Pequegnat (1974).

The origin of other major banks has not received as extensive research; however, Stetson Bank appears most like the Flower Garden Banks (Bright and Pequegnat, 1974). As exploration in this part of the Gulf continues, many new unique bathymetric features are being discovered. Figure II-6 compiled by Bright (1974), shows over sixty such banks, with most of them clustered along the 183 m depth contour offshore of western Louisiana and eastern Texas. This alignment also coincides with the Pleistocene gas deposit trend along the edge of the shelf. Major petroleum interest is being devoted to these areas and additional study

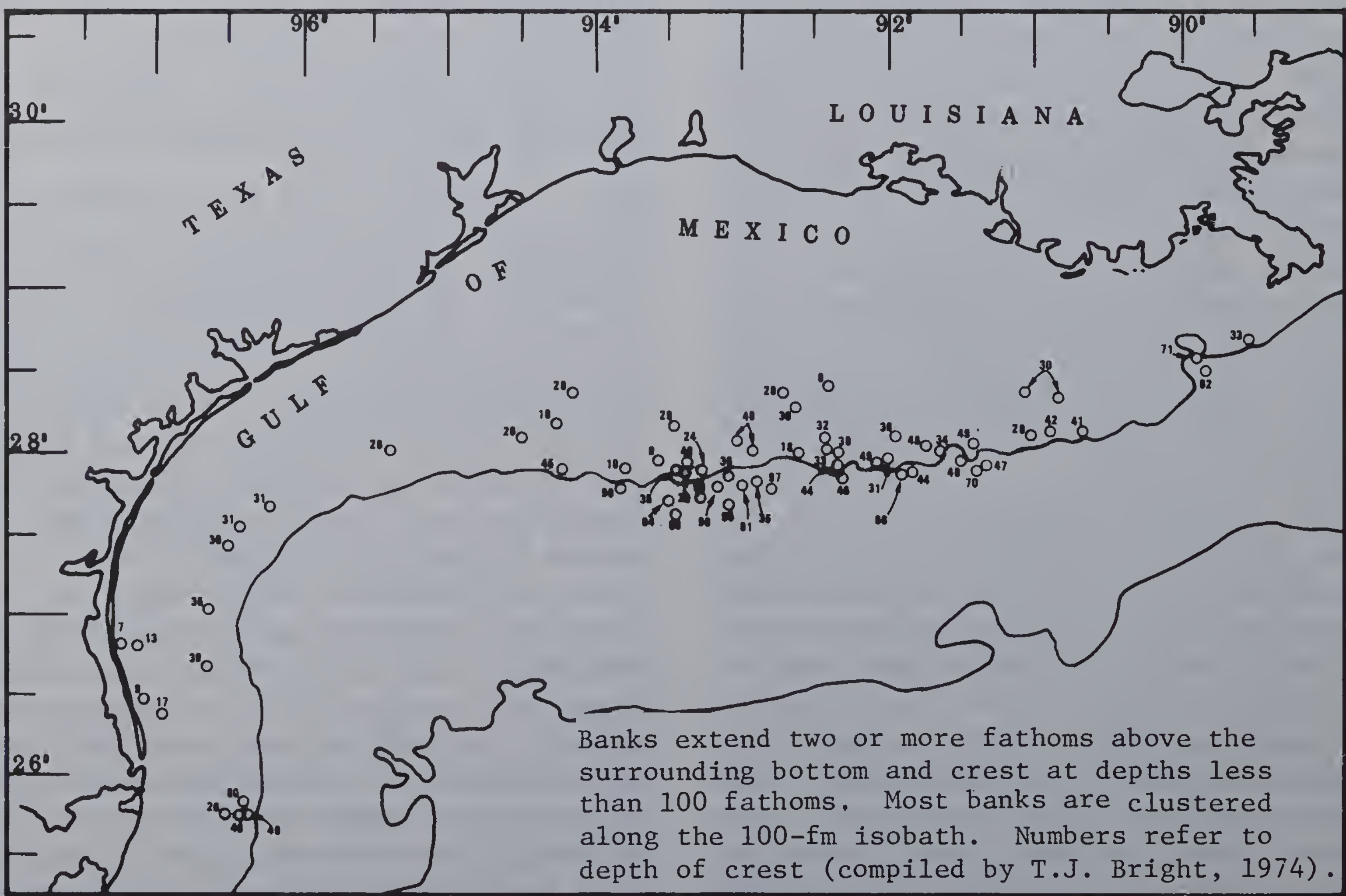


Figure II-6 Distribution of Submarine Banks in the NW Gulf of these areas seems inevitable. Detailed maps of fishing banks shown in Visual No. 4 have been prepared by Texas A & M University and DECCA Surveys, and are available in their report of Texas fishing banks to the Bureau of Land Management, New Orleans.

Various alignments of banks are obvious along the Texas coast. It is presumed that the alignment of these banks constitutes a record of ancient shorelines (Curray, 1960). Many of these banks were the result of a nearshore environment; hence, the oyster, clam and other shell deposits. In other cases, lagoonal mud deposits and nearshore beach strands have been preserved. In most cases, these banks were presumed to have developed during the Pleistocene and Holocene; however, research of many of these features has been either cursory or nonexistent. Many banks probably existed during various stands of sea level in late Pleistocene where shell growth or calcerous cementation of sediments occurred. This condition could have occurred out to the present 100 m water depth (Fig. II-7). As the beach lines migrated due to changes in sea level, the unconsolidated barrier deposits or topographic high along the beaches were destroyed and reworked; leaving the shell beds, cemented sands and clays as bathymetric highs due to their resistance to erosion.

Suspended Sediments

The following information was taken from the "Environmental Assessment of the South Texas OCS - Geologic Investigations" by Dr. Henry L. Berryhill, Jr., 1975.

The water column samples for the suspended sediment analyses were obtained from 23 stations spaced along four transects across the shelf. (See Figure II-8 for location). Samples were collected from the surface, thermocline depth, and near the bottom during the two-month interval, October 25 to December 22, 1974. When no thermocline was recorded, a water sample was obtained approximately halfway between surface and bottom. As the water samples are not synoptic, only the relative values within a specific station have any reliable scientific significance. A total of 65 samples were analyzed for sediment particle size.

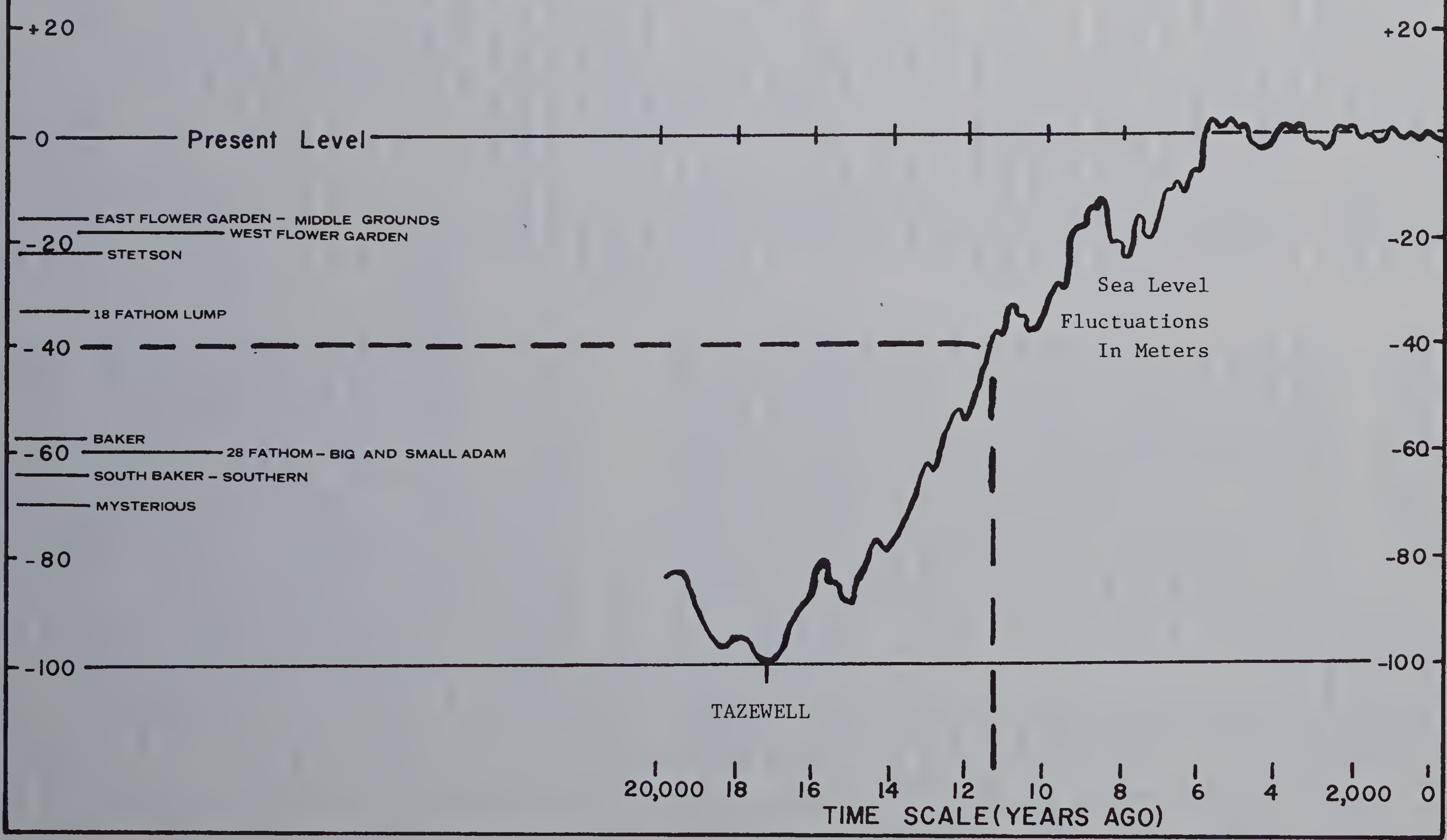
In summation, variable sediment concentration-depth relationships prevailed over the South Texas OCS during the survey period. Concentration gradient reversals occur at the majority of stations; the reversals are most frequently, but not exclusively, associated with thermoclines. The reversals can result in either concentration maxima or minima at the thermocline level. Continuously increasing concentration gradients are also frequently associated with thermoclines but can also occur in unstratified water columns. The majority of stations show a net increase in sediment concentration with depth; however, a net decrease is not uncommon, especially among the shallower stations. In essence, no systematic sediment concentration-depth relationship is readily apparent. This is attributed both to a complex thermo-density structure of the OCS hydraulic regime during the survey period as well as to the non-synoptic nature of the water samples. The water sampling phase extended over a two-month period characterized by highly variable atmospheric and sea state conditions, a factor that would tend to obscure any systematic sediment concentration-depth relationships.

5. Petroleum Geology

The most prominent structural anomalies in the northwestern Gulf are salt domes (Visual No. 2) and a series of regional, down-to-the-Gulf faults which have materially effected sedimentation across them. Less common are deep-seated, low-relief up-lifts and shale domes (Visual No. 2). These structural features are related to the presence of an underlying salt basin and the Cenozoic sedimentary wedge which has gradually advanced seaward across it.

The abundant salt dome structures around which most of the oil pools off East Texas and Louisiana have formed are rare off South Texas. Although salt is thought to be present at depth, it has not formed diapirs so freely for reasons not well understood. Large salt structures are present in deeper water near the base of the slope, but they are not structurally similar to the piercement domes to the northeast, and their trapping capabilities are not known. Several large, linear deep-seated anticlinal structures are present near the mid-shelf area but little can be said of their origin on the basis of available seismic records. In the coastal area from Corpus Christi to Matagorda Bay, a number of domes with cores of shale are present. Their extent is not fully known, but hydrocarbon production has been obtained from at least a few.

Figure 11-7 The Rise and Fall of Sea Level Following the Wisconsin Glaciation (From R. W. Fairbridge, 1960)



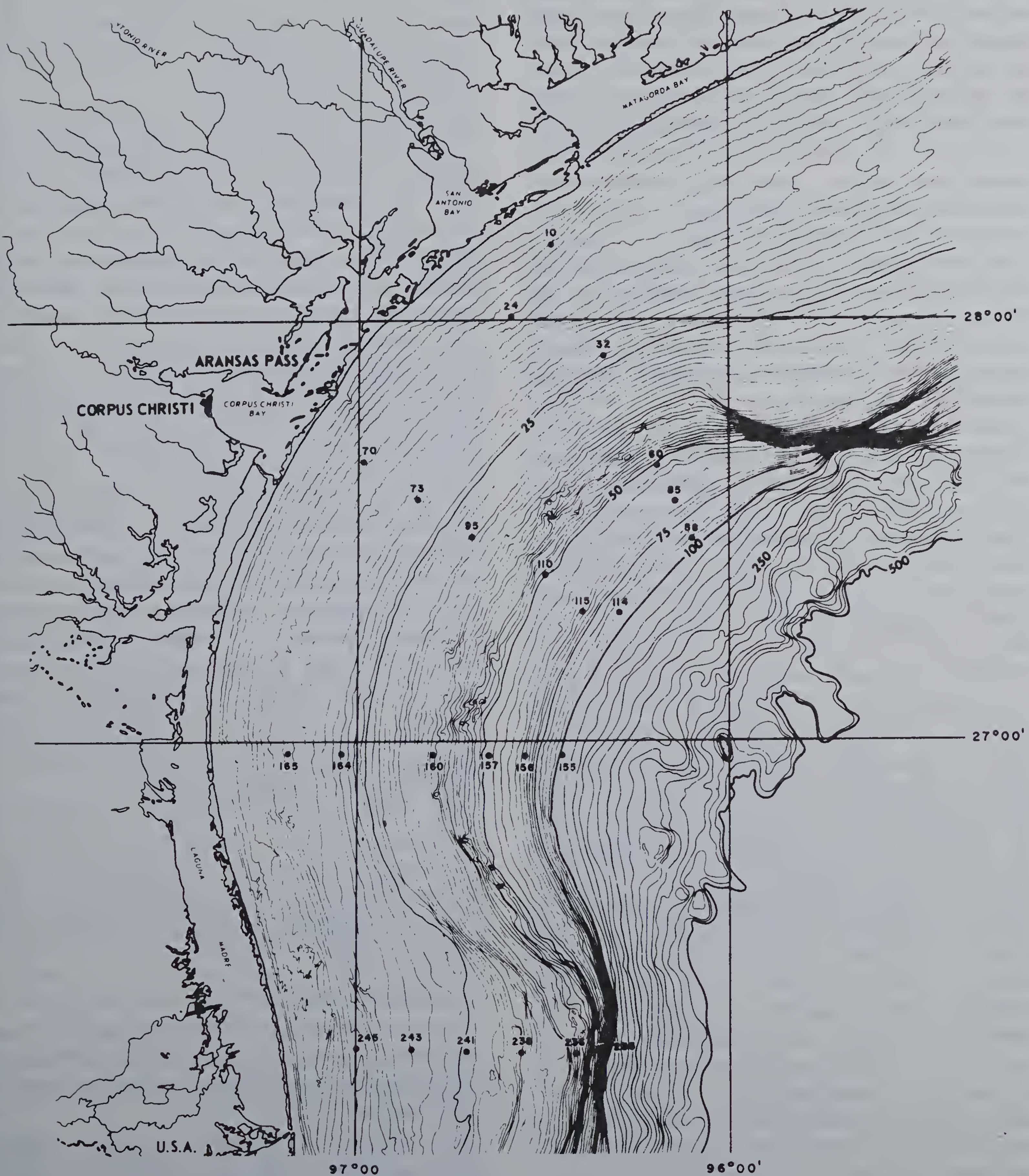


Figure II-8. Location of sample stations for suspended sediments.

Source: Environmental Assessment of the South Texas OCS Geologic Investigations (Berryhill, 1975).

A series of regional faults commonly called "growth faults" are present in the Texas-Louisiana subsurface. They are aligned approximately parallel to the coast. These are normal faults, long and arcuate in the horizontal plane, with large amounts of vertical displacement downward into the coastal basin. Rock units commonly show greater thicknesses on the downthrown sides of these faults, thus fault movement and deposition must have been essentially contemporaneous. The downthrown section acted as a topographic depression for localized deposition.

A veneer of Miocene and Pliocene overlain by a thicker section of Pleistocene derived from the Mississippi River system were supplied to the offshore Louisiana area. The Texas shelf, at the same time, received smaller volumes of sediment because it was on the western border of the Mississippi River depocenter.

Since natural production of oil and gas frequently occurs along the continental shelf-slope break, the progradation of the north-central Gulf depositional regime has resulted in the migration of this production zone seaward, developing a series of progressively younger bands of trends. Visual No. 2, shows the Late Tertiary and Quaternary production trends which underlie this area.

Future Pleistocene production from upper continental slope region (200-1,000 m water depth) adjacent to the Texas-Louisiana OCS, though certainly not improbable, remain speculative despite recent discoveries in the deeper water off the Mississippi Delta that suggest the potential of this new province. The continental slope represents the seaward face of the Gulf Coast basin and includes all of the relatively steeply sloping seabed from the shelf edge to the abyssal floor. The prospective horizon of the upper slope should consist of a thin section of Miocene and Pliocene overlain by thick intervals of Pleistocene. The Pleistocene sediments are considered the most prospective reservoir beds. The structural grain and hummocky topography of the slope are controlled primarily by salt tectonics and virtually the entire province is underlain by gigantic salt stocks and swells (Lehner, 1967; Garrison and Martin, 1973; Martin 1973).

Basinal areas between salt structures in the upper slope contain as much as 3500 m of sediments, most of which appear to be muddy slump desposits with infrequent turbidite sand zones. It has been speculated that turbidite sands of reservoir quality could conceivably be present on the upper slope, especially in deposits of Pleistocene Age, which were derived from inner shelf areas deposited during glacial epochs when the sea level was lower and shoreline was close to the present shelf edge (USDI, GS. 1976).

There are approximately 272 fields on the Federal OCS of the Gulf of Mexico. Of these 190 primarily produce gas and 75 primarily produce oil. In the remaining 7 production or productivity has not been determined yet. In September of 1975, USGS reclassified the fields in the Gulf of Mexico, as a result the number of fields has changed. Production depths range from about 328 m to 9515 m, with most production occurring between 2625 and 3938 m. USGS records show that 3.795 billion barrels of oil and condensate and 0.684 trillion m^3 of gas have been produced from Federal OCS lands as of May, 1976.

The most prolific offshore production comes from the Miocene of the eastern Louisiana OCS. This area, as currently defined, has more oil than the remainder of the Texas-Louisiana area. The next most productive trend is the Pliocene trend of central Louisiana OCS which produces about 50% oil and 50% gas. Further to the west this producing trend dies out. The Miocene of western Louisiana is the third most productive trend producing mostly gas, and the Pleistocene of offshore western Louisiana ranks fourth.

The clastic sediments derived from the ancestral Mississippi River system have built out as deltaic deposits in the Gulf. The prospective sediments underlying the Texas-Louisiana shelf are those of Oligocene, Miocene, Pliocene and Pleistocene Age.

a. Oligocene Sediments

The Frio Formation is the most prolific oil and gas producer in south Texas. About 90% of the hydrocarbon reserves in south Texas are found in this formation.

The prospective Frio section thickens seaward from a few hundred meters to more than 2000 m. Although regional structural maps indicate that a drilling depth of 4920 or more will be required to test the prospective section, the prospect of hydrocarbons in the Frio Formation appear to be slim in the South Texas OCS area.

b. Miocene Sediments

The Miocene trend is less prospective in Texas compared to offshore Louisiana. At the end of Oligocene time, the depocenters for continental-derived sediments shifted eastward, and the Mississippi River system brought to this rapidly subsiding area great quantities of sand, silt and clay. Much of this sediment was deposited in deltas and considerable amounts of clay and silt were carried by longshore currents to the innerdeltaic offshore area farther west. During the Miocene, the area of maximum sedimentation was located in southwest Louisiana but gradually shifted to southeast Louisiana, in later Miocene. The Miocene section of southeast Louisiana is the thickest in the Gulf Coast Province. Small rivers (Rio Grande, Nueces, Colorado, Brazos, Trinity and Sabine) did transport a considerable amount of sediment to offshore Texas, but they did not construct deltas of the magnitude of the Mississippi Delta. The sands that reached the sea were distributed laterally by longshore currents and formed various islands by wave actions. The finer sediments were deposited in lagoons, bays, coastal marshes and in the neritic zone. The Colorado-Brazos River system did build several large deltas during Lower Miocene time when the area north of the Balcones fault zone in central Texas was uplifted and became an important source for sediments. The largest Colorado-Brazos delta is located shoreward of East Breaks Canyon.

c. Pliocene Sediments

The Pliocene production in offshore Texas has been of little importance compared with that of Louisiana. Pliocene time was a period of uplift and erosion and the sediments that accumulated in the Gulf of Mexico or that were deposited in the coastal environment are, generally, seaward of the present shoreline. The area of maximum sedimentation in Pliocene time was located off the coast of southeast Louisiana. Much of Pliocene production is confined to the central and southeast Louisiana OCS area. Offshore Texas, two provinces are indicated to exist in the Pliocene Trend. One province occurs in the Texas offshore area south of the San Marcos Arch. Sediments there are expected to contain sand derived from the Rio Grande River and associated rivers to the north. The other Pliocene province occurs in the eastern portion of the Texas offshore and continues into the East and West Cameron areas offshore Louisiana. This province is dominated by salt domes and deep-seated diapirs. The stratigraphic sections in offshore Texas, however, are much thinner than in offshore Louisiana, and exploratory results to date in this province have proved discouraging.

d. Pleistocene Sediments

Two Pleistocene provinces are indicated in the offshore Louisiana-Texas region. The first Pleistocene province occurs from the Ship Shoal area off Louisiana to the southern portion of the Galveston area offshore Texas. This province has a thick sequence of Pleistocene sediments with favorable stratigraphic conditions for both the generation and entrapment of hydrocarbons in porous rock, and structurally is characterized by salt domes and deeper-seated shale domes and ridges. The trend area, to the east (in West Cameron), is presently being developed as a gas producing province. Several fairly large gas fields have been found, some with associated condensate and oil reservoirs. Also, oil and gas discoveries, have been drilled in acreage offshore Texas High Island area which was leased in June 1973, East Texas Sale No. 34. The potential of this province is very good.

The second province occurs offshore southwest Texas, and generally is made up of the Pleistocene offshore delta of the Rio Grande River. The Rio Grande built a subaqueous delta which prograded across the continental shelf and continental slope. The Pleistocene sediments are typified by a fairly sizable quantity of sand deposited under dominantly marine conditions, with interbedded deposits of continental sand material.

B. Climate

1. General Description

The climate of the northern Gulf of Mexico and adjacent coastal region is determined by four major factors; the North American Continental land mass, the Azores-Bermuda high pressure cell, subtropical latitude, and the relatively warm waters of the Gulf of Mexico itself. The principal influence being the Gulf, resulting in a maritime tropical climate for the region.

During the winter, polar continental air masses move southward into the Gulf of Mexico causing occasional sudden drops in temperature. As these cold fronts reach the Gulf of Mexico, the maritime tropical air flowing northward causes the fronts to abate and become stationary. These stationary fronts are favorable for the formation of low centers that often move west to east along the Gulf Coast or move inland producing low clouds and rain. The cold continental air masses have a tendency to lower the sea surface temperature offshore. The cold water temperatures cause the formation of advective fog in coastal areas from November to March.

By spring, the Bermuda high develops its influence over the region thus improving the weather considerably. The ridge of high pressure usually blocks the movement of storm systems from the west. Occasionally, tropical disturbances and easterly waves will appear in the Gulf of Mexico by early summer (U.S. Dept. of Commerce, 1972).

During the summer, southerly winds of the Bermuda high bring warm moist tropical air onshore. Daily shower activity occurs in near shore waters and along the coast with most activity in the afternoon. Westerly and northerly winds generally bring periods of hotter and drier weather into the region.

Easterly waves and tropical storms appear in the Gulf during late summer and early fall. The principal paths of tropical storms into the Gulf are through the Yucatan Channel and Straits of Florida. Over half of these tropical storms become hurricanes during this season. During October and November, the Bermuda high loses its strength and allows continental air to again exert influence on the Gulf of Mexico and coastal region.

2. Pressure, Temperature, and Relative Humidity

a. Pressure

The western extension of the Bermuda high pressure cell dominates circulation throughout the year, weakening in winter and strengthening in summer. The average monthly pressure reaches a minimum in summer ranging from 1014 millibars to 1016 millibars from west to east over the northern Gulf of Mexico region. The average monthly pressure reaches a maximum of 1021 millibars during the winter in this region. The maximum average monthly pressures result from the influence of continental cold air present during winter. The minimum pressures occur during the summer when the equatorial trough shifts northward influencing the region.

b. Temperature

Average temperatures at coastal locations vary with latitude and exposure. In winter they depend on the frequency and intensity of penetration by polar air masses from the north. These incursions, when they bring strong northerly winds, are called "northers" and may occur some 15 to 30 times between November through March.

Air temperatures over the open Gulf exhibit narrower limits of variations both on a daily and seasonal basis (Fig. II-9). In the summer, average temperature over the center of the Gulf is about 29° C. Winter air temperatures in the eastern and central Gulf of Mexico near the coastal areas affected by this proposed sale average between 17-20° C.

c. Relative Humidity

Over the entire region, the relative humidities are high throughout the year. Maximum humidities occur during the spring and summer months when prevailing southerly winds bring warm moist air into the area. Minimum humidities occur when cold continental air masses bring dry air into the northern Gulf of Mexico during the late fall and winter. For recording stations from Brownsville, Texas, to Appalachicola, Florida, the relative humidity annually varies from a high of 87% at 6 a.m. to a low of 63% at 12 noon. This variation in a six hour period is caused by daily warming. Relative humidity decreases during the day as a function of rising temperature and precipitation.

3. Surface Winds

The Azores-Bermuda atmospheric high pressure cell dominates the circulation over the Gulf OCS,

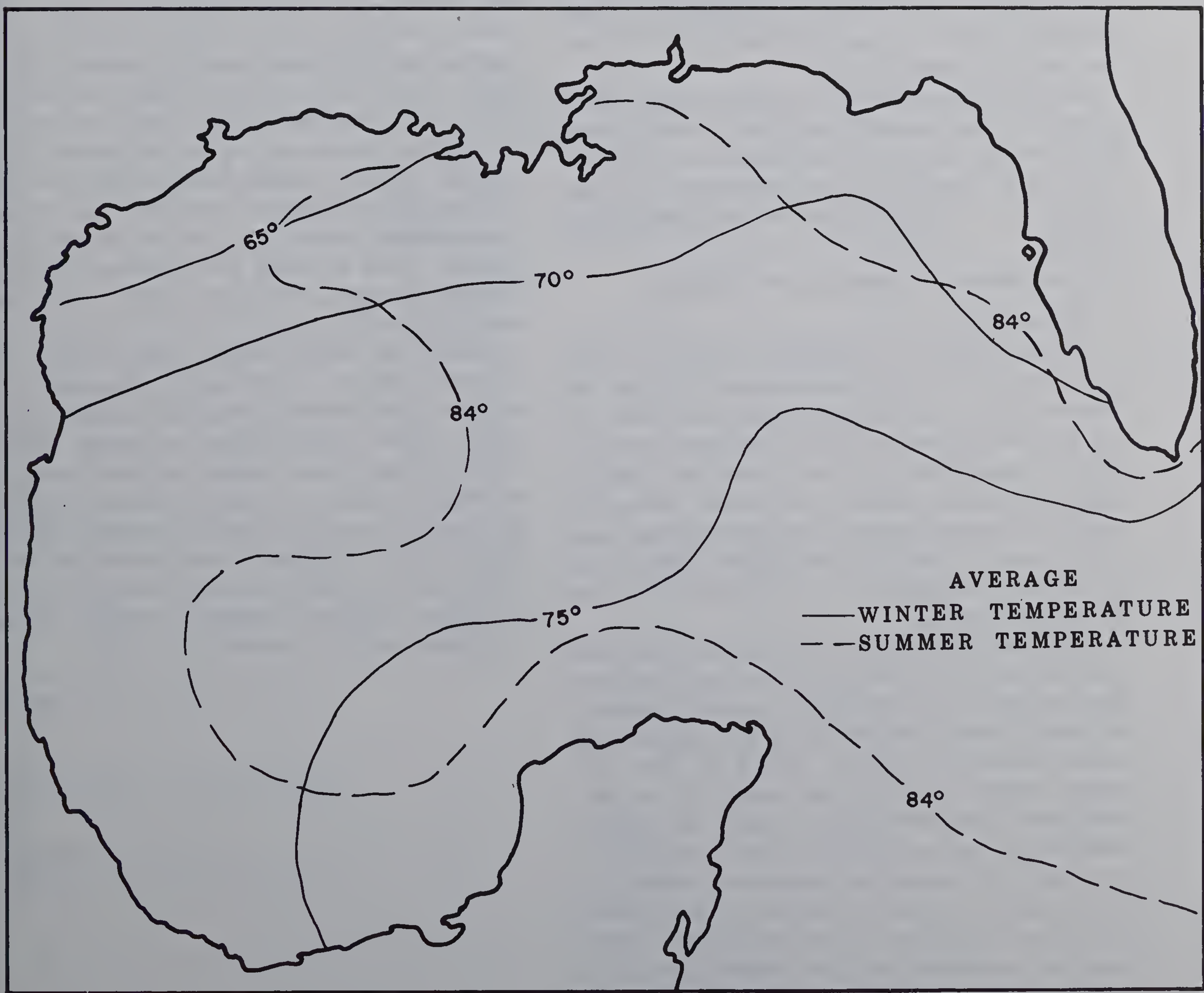


Figure II-9 Average summer and winter surface air tempteratures in °F for the Gulf of Mexico (Leipper, 1954).

particularly during the spring and summer months. In late summer there is a general northward shift of the circulation and the Gulf comes under the more direct influence of the equatorial low pressure belt. During the relatively constant summer conditions, the southerly position of the Azores-Bermuda cell brings about predominance of south-easterly winds. The winds tend to become more southerly in the northern part of the Gulf. During the winter, winds usually blow from easterly directions with fewer southerlies but more northerlies. Winds from west and southwest are rare anytime during the year.

Near the coast, winds are more variable than over the open waters because the coastal winds fall more directly under the influence of the moving cyclonic storms that are characteristic of the continent and because of the sea and land breeze regime.

4. Precipitation, Cloudiness, and Visibility

a. Precipitation

Average annual precipitation along the Gulf coast increases from approximately 69 cm at Brownsville to over 102 cm at Galveston, and 137 cm at New Orleans. Rainfall is fairly evenly distributed throughout the year, with the greatest amounts occurring during the months when the winds are predominantly out of the southeast and south, namely June, July and August. This is not to imply a continuity of precipitation for the South Texas region.

Along the eastern part of the proposed sale area precipitation is frequent and abundant throughout the year but does show distinct seasonal variation. At New Orleans, October is the only month with a precipitation average less than 8 cm. July, the wettest month, receives just under 18 cm. Stations along the entire coast record the highest precipitation values during the warmer months of the year. The month of maximum rainfall for most locations is July, however, at Brownsville the record maximum is in September. Winter rains are associated with the frequent passage of frontal systems through the area. Rainfalls are generally slow, steady and relatively continuous, often lasting several days. Snowfalls are rare, and when frozen precipitation does occur it usually melts upon contact with the ground. Incidence of frozen precipitation decreases with distance offshore and rapidly reaches zero.

The warmer months usually have convectiv cloud systems which produce showers and thun derstorms; however, thunderstorms of this typ rarely cause any damage or have attendant hai Tornadoes and waterspouts are also rare in thi area (Brower et al., 1972).

b. Cloudiness

Along the Texas and Louisiana Gulf coas cloudiness averages between ⅜ to ⅝ sky cove with relatively small seasonal variation. Th cloudier season is winter and early spring wit summer and fall being generally clearer. The Climatic Atlas of the U.S. (U.S. Dept. of Commerce 1968) shows that the central Gulf Coast receive the highest percentage of possible sunshine in th summer and fall, ranging between 60% and 70% with the high in October. The percentage of possible sunshine declines to a low in December and January (50% or less) and increases gradually through the spring and early summer into the 60% range (Table II-2).

During the warm season, May through September, cumulus clouds begin developing over northern Gulf waters about 0300 hours and the larger clouds may produce scattered showers which dissipate when carried onshore during the morning by the sea breeze. Onshore cumulus development occurs during the day reaching maximum in late afternoon, often accompanied by rainfall (Orton, 1964). Much of the summer clouds are either convective cumuli or high, relatively transparent clouds (Brower et al., 1972).

Table II-1. Tropical Cyclone and Hurricane Frequencies in the Gulf of Mexico

	Total Number 1899-1971		Average No. Years Between Occurrences	
	Tropical Cyclones	Hurricanes	Tropical Cyclones	Hurricanes
Corpus Christi Area (26°-29° N, 95°-98° W)	41	25	1.8	2.9
Galveston-Freeport Area (28°-30° N, 94°-97° W)	35	23	2.1	3.2
Sabine Pass Area (28°-30° N, 92°-95° W)	32	15	2.3	4.9
Bayou Lafourche Area (28°-30° N, 89°-92° W)	45	18	1.6	4.1
Southwest Pass Area (28°-30° N, 88°-91° W)	49	18	1.5	4.1
Mobile-Pascagoula Area (29°-31° N, 87°-90° W)	41	15	1.8	4.9
Panama City Area (28°-31° N, 84°-87° W)	52	19	1.4	3.8

Source: U.S. Department of Commerce, NOAA, 1972. Environmental Guide for the U.S. Gulf Coast

TABLE II-2 High Wave Occurrences in the Gulf of Mexico

Mean Recurrence Interval	Maximum* Significant Wave Height (Meters) 5 yr.	10 yr.	25 yr.	50 yr.
Corpus Christi Area (26°-29° N, 95°-98° W)	10.1	11.3	12.8	14.0
Galveston-Freeport Area (28°-30° N, 94°-97° W)	8.8	9.8	11.3	12.5
Sabine Pass Area (28°-30° N, 92°-95° W)	9.1	10.1	11.6	12.8
Bayou Lafourche Area (28°-30° N, 89°-92° W)	9.5	10.4	11.9	13.1
Southwest Pass Area (28°-30° N, 88°-91° W)	9.5	10.4	11.9	13.1
Mobile-Pascagoula Area (29°-31° N, 87°-90° W)	9.5	10.4	11.9	13.1
Panama City Area (28°-31° N, 84°-87° W)	9.5	10.4	11.9	13.1

Source: U.S. Department of Commerce, NOAA, 1972. Environmental Guide for the U.S. Gulf Coast.

* Significant Wave Height indicated the approximate height of one-third of highest waves observed. There may be higher waves in the wave field called extreme waves that can be estimated by applying a 1.8 factor to the significant wave height. However, in most cases extreme wave heights are limited to a value of one-half the water depth.

c. Visibility

Warm, moist Gulf air blowing slowly over chilled land or water surfaces brings about the formation of the fog. The period from November through April has the highest frequencies of low visibilities. On the south Texas coast, fog reduces visibility to less than ⅝ of a mile on an average of 28 days a year. Very dense fog in Galveston makes visibilities of ⅜ of a mile about 16 days a year. Port Arthur has an average of 42 days each year in which visibility is less than ⅜ of a mile. Visibility around the Mississippi Delta may be lowered by industrial pollution from New Orleans or burning marshlands.

Fog occurence does decrease seaward but there have been visibilities less than ½ mile due to fog offshore.

Generally, coastal fogs last three or four hours although particularly dense sea fogs may persist for several days. Visibility offshore Louisiana is reduced to less than 5 km on a monthly average of 4% of the time. Poorest visibility conditions occur during winter and early spring when visibility is reduced to less than 5 km between 8% and 10% of the time (Peake and Muller, 1971).

5. Severe Storms

a. Tropical Cyclones

The largest and most destructive storms affecting the Gulf of Mexico and adjacent coastal zones are tropical cyclones. These have their origin over the warm tropical waters of the central Atlantic Ocean, Caribbean Sea or southeastern Gulf of Mexico. They occur most frequently between June and late October (Brower, et al., 1972) and there is a relatively high probability that tropical cyclones will cause damage in the Gulf of Mexico each year. Statistics for hurricanes and tropical cyclones are often lumped together since it is often difficult, especially in the older records, to determine the storm intensity while at sea. Table II-1 lists the frequencies of tropical cyclone and hurricane occurrence for various stations along the coast of the Gulf of Mexico (U.S. Dept. of Commerce, 1972). Hurricanes vary considerably in intensity track patterns and behavior upon crossing land. McGowen, et al. (1970), explains that the storm approach is marked by rising tides and increased wind velocities; generally the longer a storm lingers in the Gulf, the larger the bulge of water it pushes ashore as it approaches land. These storm tides are commonly higher in the bays than on Gulf sea beaches, although flooding and pounding waves effect both areas.

There is no preferred approaching route of hurricane tracks although early season cyclones approach generally from the southeast while later ones are more out of the south. In spite of the fact that most hurricanes form in tropical ocean areas, a few are generated in the Gulf of Mexico. During the period 1901-1971, seven hurricanes and seven tropical storms formed in the Gulf north of 25° N and east of 85° W. See General Gulf, Visual No. 2 for 1954-1975 hurricane tracks.

Damage from hurricanes results from high winds and, particularly in the coastal areas, the storm surge or tide which is an abnormally high rise in the water level. Maximum surge height at any location is dependent on many factors including bottom topography, coastline configuration and storm intensity. The storm surge associated with "Betsy" in 1965 reached nearly 1.6 m at Bayou Lafourche (U.S. Dept. of the Army, 1973); Hurricane "Carla" in 1961, produced 7 m tides in Lavaca Bay, Texas. Hurricane "Camille" was the most severe hurricane in recent Gulf history, with top winds estimated at 324 km/hr, and barometric pressure in her eye as low as 68 cm of mercury.

The flood tides and high waves carry shells and sediment from deeper offshore areas onto seaward beaches, spreading a veneer of deposits over the broad, flat hurricane beaches. In the marsh areas extensive and prolonged inundation and ponding occurs, resulting in damage or loss of habitat and man-made structures. The storm surge flood may also produce breaches or channels in natural barrier islands or in levees.

b. Extratropical Cyclones

In addition to the tropical cyclones, extratropical cyclones that may vary greatly in intensity occur in this area primarily during the winter months. These storms have attained wind speeds as great as 55 to 93 km/hr. They originate in middle and high latitudes forming on the fronts that separate different air masses. The Gulf of Mexico is an area of cyclone development during the cooler months due to the contrast in temperatures of the warm air over Gulf waters and the cold continental air over the United States. These storms rapidly dissipate, or move on, after entering the Gulf of Mexico.

c. POLAR OUTBREAKS

A phenomenon known as "norther" is quite common in the area in question during the winter months. A norther occurs when cold, polar air moves southward from the cold interior of the North American continent out over the warm waters of the Gulf. This unstable cold air mass, when heated from below, develops strong gusty northerly winds, with considerable cloudiness and showers. During a typical winter as many as 30 such Polar outbreaks reach the Gulf Coast. The majority of these cold outbreaks, spilling out over the Gulf, produce winds in the 28-37 km/hr range but approximately one-third of these cold outbreaks have winds over 62 km/hr with approximately half of these being vigorous enough to reach 89 km/hr (U.S. Dept. of Commerce, 1967).

C. Physical Oceanography

1. Circulation

a. Loop Current

The complex circulation in the Gulf of Mexico is dominated by the Loop Current. In general, the large scale circulation in the Gulf of Mexico is attributable to four major factors: Yucatan Currents, tides, winds, and river discharges (Eleuterius, 1974). Eddy currents off the major loop probably account for northern growths of coral such as the Florida Middle Grounds, offshore Florida, and the Flower Garden reefs, offshore Texas. Current trajectories in the Gulf have been mapped for many years by the Naval Oceanographic Office (1955). The Surface Current Wind Roses for the Gulf of Mexico, shown in Visual No. 6, are from a compilation of Naval Oceanographic Office Data. Additional Loop Current data are contained in: USDI, GS (1975), Eleuterius (1974) and Sweet (1974).

The Loop Current is a major feature of the Central and Eastern Gulf. It is a continuation of the Yucatan Current that enters the Gulf of Mexico through the Yucatan Straits. Although the current shows great annual and seasonal variability in magnitude and course, in general, it penetrates some distance into the Gulf, turns clockwise and exits through the Florida Straits. The path of the Loop Current appears to be directly influenced by the topography of the Gulf of Mexico Basin (General Gulf, Visual No. 1).

The northward progression of the Loop Current varies from the edge of the continental shelf off the Mississippi River in August to the southeastern Gulf in mid-winter. During spring and summer current speeds in the core of the current approach 0.25 m per second (Figs. II-10 and II-11).

Large eddies frequently separate from the main current and drift into the western Gulf, these spin-offs decay over a period of three to six months (Eleuterius, 1974). No significant permanent or semi-permanent shelf currents exist in the western Gulf as a result of the Loop Current. Figure II-10 shows the northerly extent of the current parallel to the continental shelf of east Louisiana, Mississippi, Alabama and Florida. An eddy is in the process of being formed on the western loop boundary and will eventually drift westward. The intensification on the loop can be seen as streamlines constrict thus causing velocities to increase. The streamlines represent a certain volume passing through a plane perpendicular to the contours in a given time, therefore velocities must increase to maintain this volume of flow as streamlines constrict. Figure II-12 represents a fully developed eddy with associated transitional streamlines.

b. Surface Circulation

Figure II-13 depicts surface circulation trends along the Louisiana coast, emphasizing the general westward movement of currents. The nearshore regime in this area is influenced by several factors, among them winds, tides, offshore current flow and fresh water discharge from coastal rivers. In most areas significant winds are the major control of surface currents.

Currents around the Mississippi Delta are strongly influenced by the fresh water outflow from the river. At Head-of-Passes the Mississippi River branches into three major channels: Pass-A-Loutre, transporting 31.5% of the total river discharge; South Pass, 17% and Southwest Pass, 31.5% (Dept. of Army, 1976). Fresh water discharge rates vary seasonally with highest values occurring during the spring and lowest in the fall. Outflow from the Mississippi Delta maintains its general integrity as it passes over the more dense, saline underlayer. Scruton (1956) observed a fresh water plume extending 20 km off Pass-A-Loutre. This has been confirmed by Eleuterius (1974) whose data indicate that at times this plume extends some 64 km eastward. Fresh water plumes to the south and west are less well known, however, they undoubtedly exert considerable influence.

In the vicinity of the Mississippi River Delta surface salinities range from 0.0 parts per thousand (ppt) to 36.0 ppt, in a distance of 16 km. During winter, high salinity cells are a permanent feature of the area. Low-salinity waters spread eastward of the shelf during spring and summer. Similarly, in winter temperatures increase seaward from 10° C nearshore to 22° C at the shelf break. In summer, temperatures decrease seaward from an extreme of 33° C nearshore to 29° C at the shelf break. These two factors, salinity and temperature, are responsible for the density gradients that exist over the shelf near the Mississippi River Delta. Areas of dense water tend to mix toward higher temperature water and conversely high salinity water mixes toward lower salinity water.

Figure II-10 Loop Current Streamlines, August, 1966. (Eleuterius, 1974)

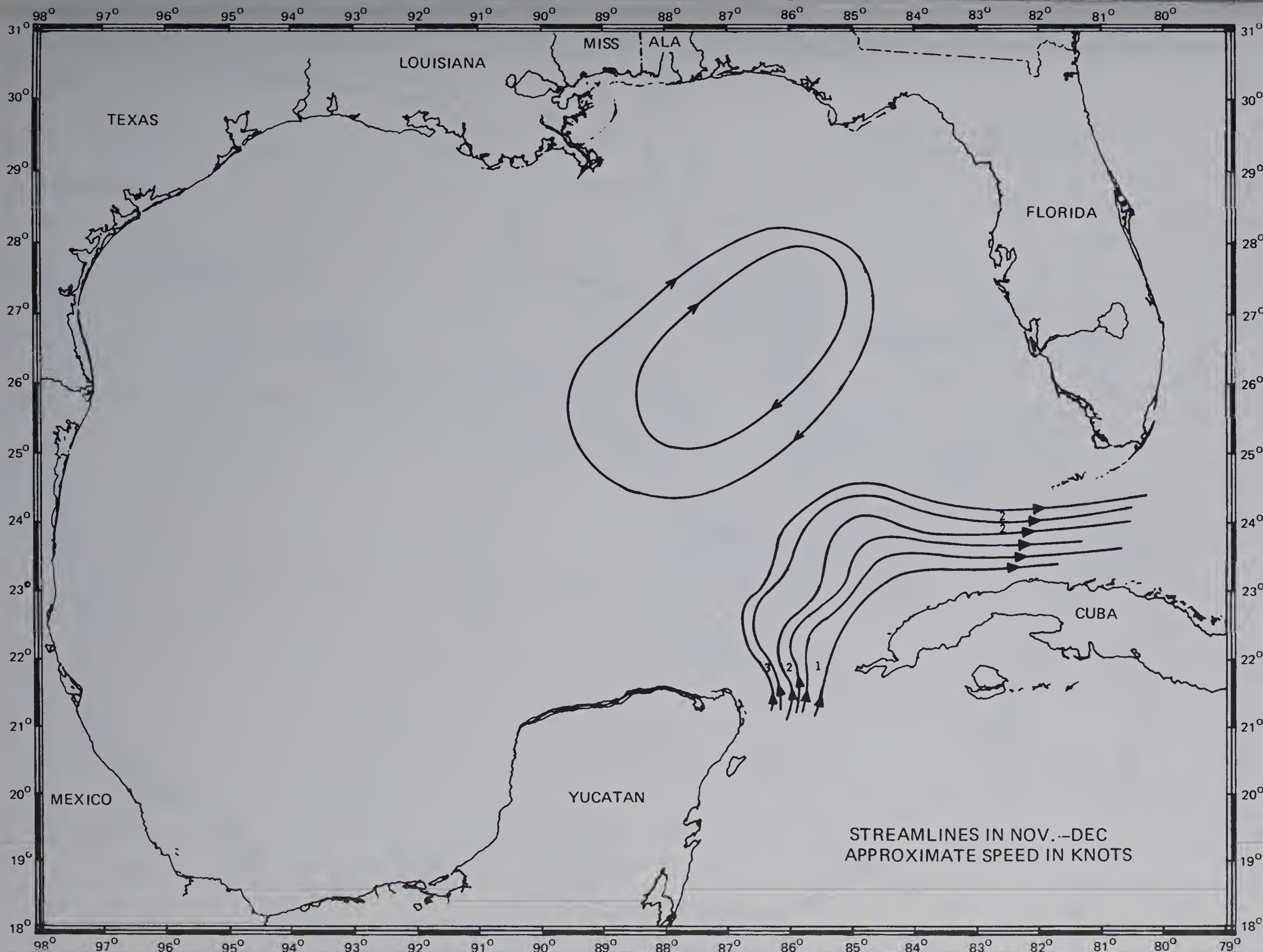


Figure II-11 Loop Current Streamlines, December, 1965. (Eleuterius, 1974)

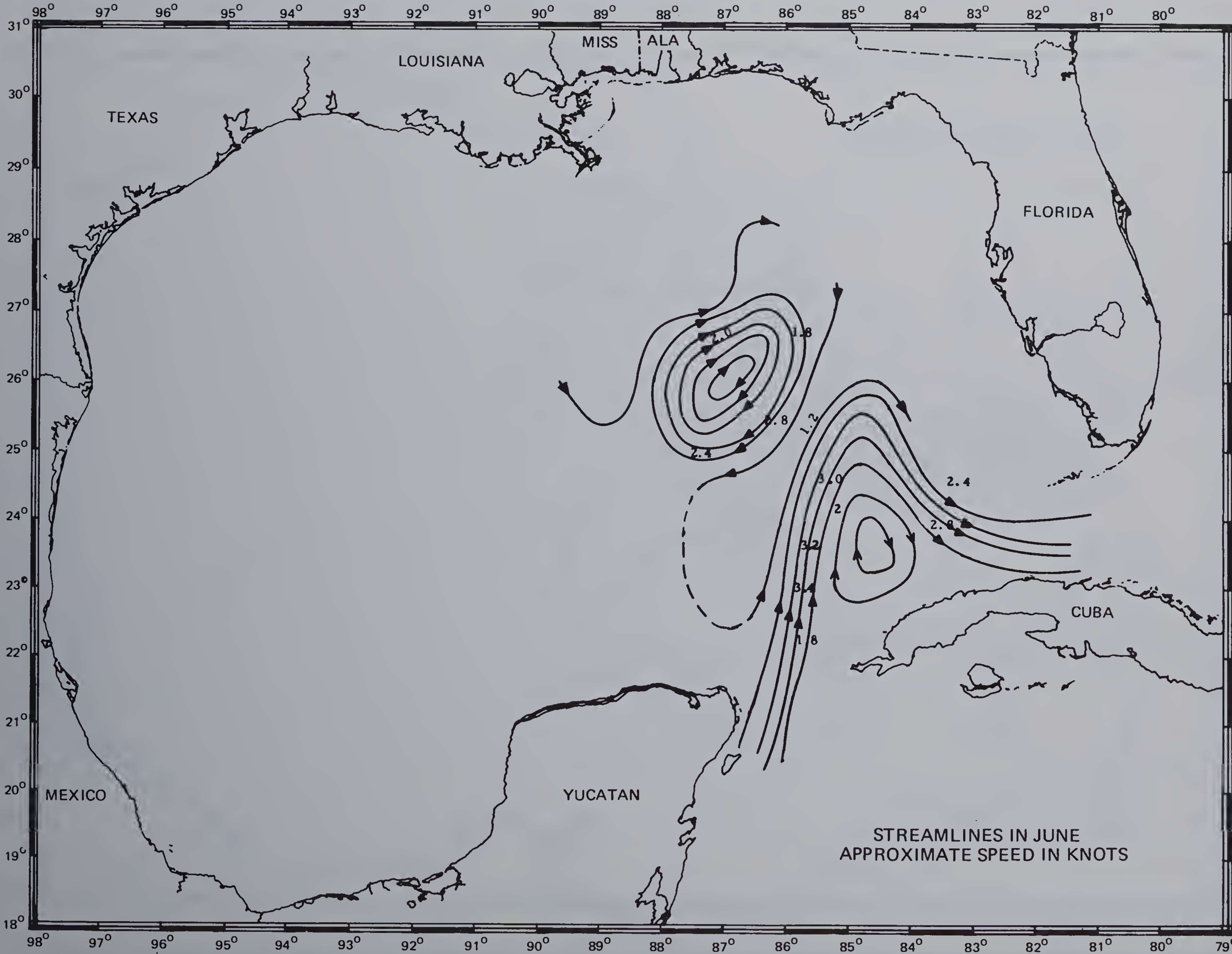


Figure II-12 Loop Current Streamlines, June, 1967. (Eleuterius, 1974)

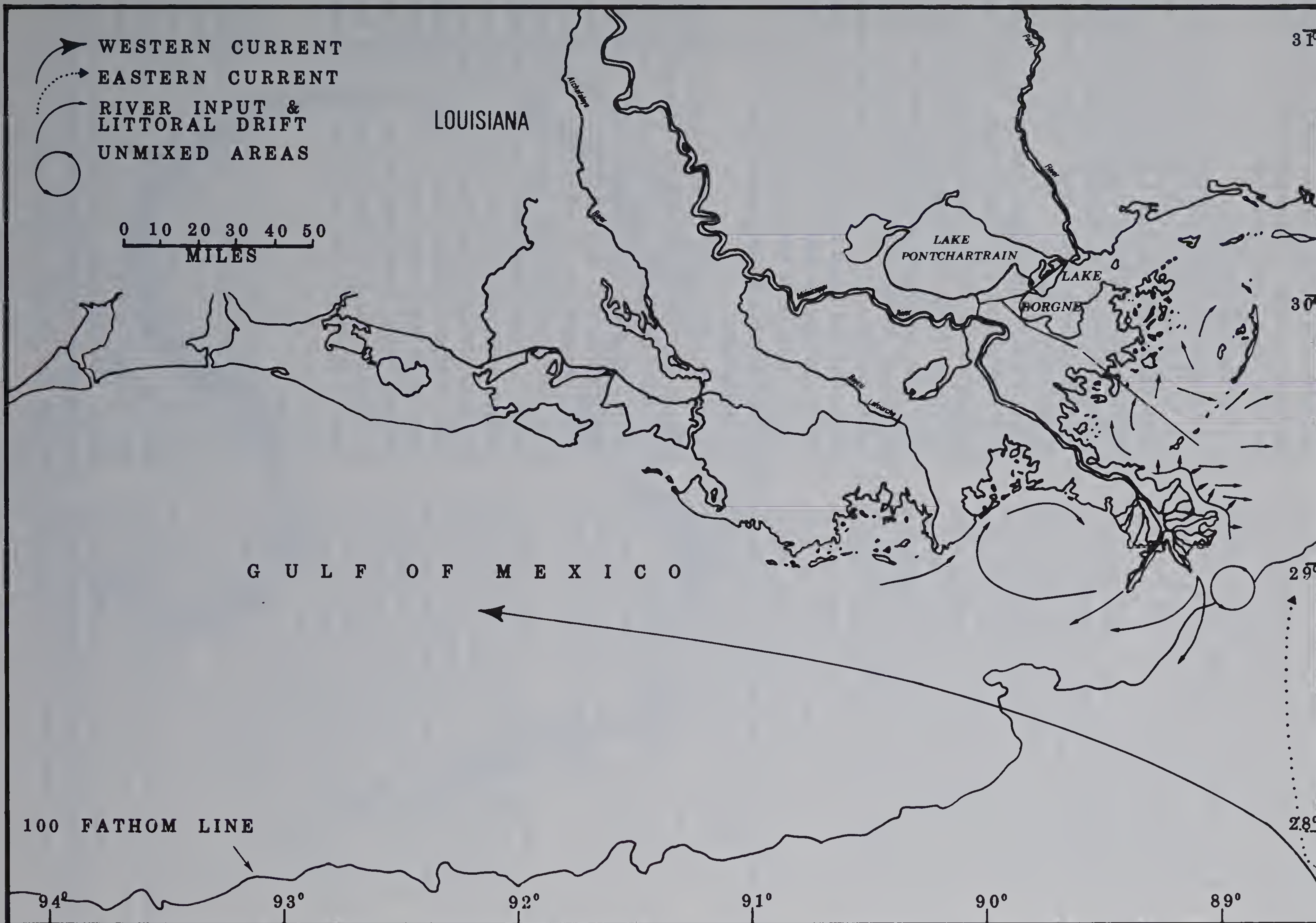


Figure II-13 Generalized surface circulation along the Louisiana continental shelf (from Stone, 1972).

Wind driven circulation is caused by the frictional drag produced as wind passes over water. Wind stress, applied at the sea surface causes net transport of subsurface water at an angle (deflected to the right in the Northern Hemisphere) proportional to the depth. Discussion of wind fields in the proposed sale area has been included in the Climatology Section and portrayed annually in Visual No. 6.

Surface currents in the South Texas proposed lease area shift seasonally and, in general, reflect the prevailing winds over the area. Currents from September through February are southwesterly with indications of a southerly alongshore or offshore movement in November and December. A period of transition occurs in March-May when currents shift to west then to the northwest. Surface current flows north and east alongshore in June and July. Finally, in August, currents are westerly before resuming the September regime (NOAA, 1976). Analysis of drift bottle data indicates three current systems off Texas; inshore, shelf, and oceanic during the March-May transitional period.

There is a general westward sweep of currents along the Louisiana shelf west of the Mississippi Delta. This current continues as a southerly-oriented boundary current along the west Louisiana and Texas coasts (Fig. II-14) until it reaches the South Texas area. This table however does not reflect the strong month-to-month current changes.

Studies done by the National Marine Fisheries Service indicate the existence of a zone of convergence that develops in the waters of the inner and middle shelf. This convergence is most pronounced in spring when the nearshore location tends to shift up the coast. The convergence develops as a result of contrasting direction of flow between the nearshore and offshore water. This zone is absent during winter (October through February) when currents are predominantly west and south across the entire shelf. Density structure and wind are also very important factors in forming the currents in the Western Gulf.

In conclusion, currents in the Gulf of Mexico are influenced by wind in the western portion and by density differences and the Loop Current in the eastern portion. During the summer the Loop extends far into the northern Gulf causing an easterly flow past the slope off the Mississippi Delta. A counter current caused by density gradients and wind stress flows westward nearshore along Louisiana and turns southwesterly on the Texas shelf.

c. Bottom Circulation

Several recent monitoring efforts in the eastern Gulf of Mexico have shown there may be no apparent relationship between surface currents and bottom currents. Although current measurements on the shelf bottom are feasible, they are so rare that very few conclusions can be drawn concerning circulation patterns.

The South Texas Baseline Study has provided some information regarding bottom currents on the Texas shelf. Surface drift was found to correspond to bottom drift during early fall and midwinter. The transitional periods of spring and late fall showed no relationship between bottom and surface currents (NOAA, 1976). A bottom convergence zone was found several miles south of the surface convergence zone. On other occasions the bottom convergence zone was found north of the surface area.

2. Temperature

According to Leipper (1954), the main feature of the average winter sea surface temperature for the Gulf of Mexico is a gradual drop from approximately 24° C in the south to 18° C in the north in all parts of the Gulf. In the summertime, average temperatures are very nearly uniform at 29° C throughout the Gulf. In the colder months there is a strong onshore-offshore temperatures gradients over the shelf area. Years of investigations have shown that considerable deviation from these average isotherms may occur at certain times. In shallow coastal waters and in estuarine and marsh areas, water temperatures approximate air temperatures, but without reaching the extremes exhibited by air temperatures on short term.

3. Tides

The tides of the Gulf of Mexico are weakly developed and usually their observed range does not exceed 0.7 m (Durham and Reid, 1967). Semidiurnal (twice daily) tides are small, and therefore, overall tides in the Gulf are considered diurnal (daily) in character. In 1897, R. A. Harris (Grace, 1932) suggested that the diurnal tides of the Atlantic Ocean influences the tides in the Gulf through the Yucatan Channel. Later in 1900, he

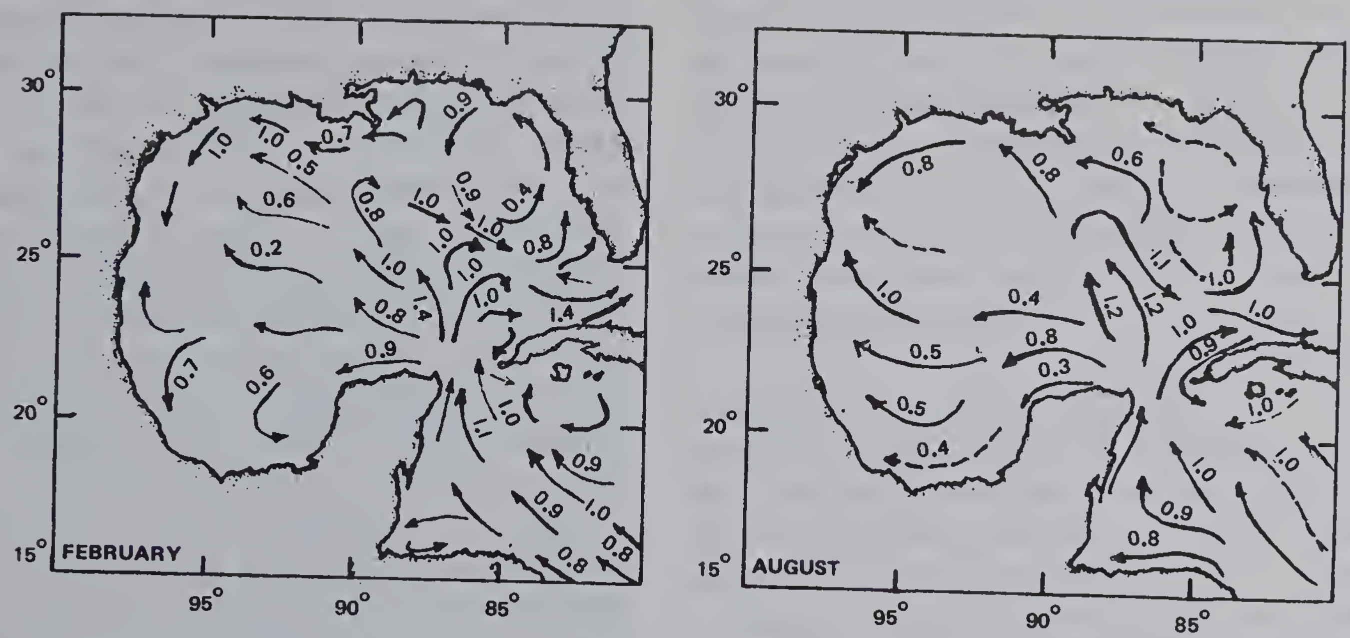


Figure II-14 Estimated Average Speed (Knots) of Surface Currents in the Gulf of Mexico from U. S. Naval Oceanographic Office Pilot Charts for February and August (After Nowlin, 1971)

From Eleuterius, C. K. 1974. Mississippi Superport Study, Environmental Assessment.

Figure II-15
Gulf of Mexico Tidal Regimes.

expressed the opinion that a single oscillating system with a nodal line extending from western Haiti to Nicaragua is formed by the Gulf of Mexico and the Caribbean Sea. This would cause the tides of the Gulf to be simultaneous. In 1908, Enros (Grace, 1932) arrived at a similar conclusion considering the Gulf and the Caribbean Sea to be a single oscillating body with a period of nearly 24 hours. Tidal regimes have been shown for the Gulf of Mexico as displayed by Eleuterius (1974) in Figure II-15.

In 1908, C. Wegmann (Defaunt, 1961) considered the resonance effect of the diurnal components of the Gulf tides and found the period of free oscillation for an east-west oscillation to be 24.8 hours. According to Grace (1932) the diurnal tide enters through the Florida Straits, progresses counterclockwise around the basin, is reflected by the northwestern and southern coasts and egresses through the Yucatan Channel.

When the moon is near its maximum declination, the tide is diurnal and has the greatest range. When the moon is over the equator, the tide has the least range and there may be several days having two highs and two lows. Although tides in the Gulf have a small range they do have important roles in modifying currents and accelerating the movement of water through narrow passages.

Spring tides are slightly higher, but since the range is too small, meteorological effects can completely mask tidal fluctuations (U.S. Dept. of Commerce, 1967). For instance, an onshore wind can pile-up water against the coast to a height of 1.2 m above mean sea level. Tides are diurnal (one high and one low per day), with maximum ranges recurring about every two weeks (Stone, 1972). Highest mean water level occurs during the period December through March.

Tidal currents do have some small effect on flushing rates in enclosed bays, but because tidal ranges are small, currents resulting from tides are also small.

4. Sea, Wind, Waves and Swells

The coastline of the region of the proposed sale is characterized as a low energy area in terms of wave power (Stone, 1972). The annual average wave heights are 0.9 m (Brower, et al., 1972), with 75% of all waves being smaller in height than 1.5 m.

Direction and height of waves at an offshore station closely correlates with wind direction and intensity. On an annual basis waves come out of the northeast, east, southeast, and south 70.9% of the time (Stone, 1972). July and September data reflect the strong influence of the southerly winds resulting from circulation around the Bermuda High. The shift to more northerly and northeasterly wave origin accompanies the change in wind direction in winter when it is dominated by continental air masses and "northers". From May to August 80% to 90% of the waves were 1.5 to 2.4 m in height, and less than one percent exceeded 3.7 m in height. Waves from the northeast and southwest tend to have greater heights than those from other directions.

Stone (1972) reported that wave power along the coast is less during spring and summer and greater during autumn and winter by a factor of 2 or 3. He further states that the Mississippi and Atchafalaya (off Vermilion) deltas are advancing and the Barataria and Terrebonne coastlines are retreating. In the latter case, the rate of retreat is 7 to 15 m/yr, in the former case it is 3 to 7 m/yr.

The wind velocity, the distance over which the wind blows (fetch), and the length of time that the wind blows (duration) all have a direct effect on wave growth. In general, any increase in one of these factors will result in larger waves. Sea is a term applied where waves are actively being generated. Swell refers to long period uniform waves some distance from the generating influence.

Prevailing winds during spring, summer and early fall are from the southeast and wave heights are generally less during this period. Waves associated with storms range considerably higher. During hurricane "Camille" in 1969, for example, waves 21 m high were reported offshore, with winds exceeding 322 km/hr. Table II-2 gives an estimate of high wave occuruences for seven areas of the Gulf coast.

Due to the Coriolis effect sea breezes rotate clockwise in the northern hemisphere during a 24-hour period. Usually the sea breeze will start around 1000 hours, reach a maximum at 1400 hours and afterwards be replaced by the nocturnal land breezes. To provide information on amplitude phase and frequency of responding waves, currents and beach erosion and deposition, a fully instrumented project was undertaken on Santa Rosa Island, Florida, by Sonu, et al. (1973). Their results demonstrated that sea breezes significantly affected the dynamic processes operating on the coast in the following summary:

(1) Meteorological parameters such as aerodynamic roughness, shear stress and atmospheric stability exhibited definite coupling with the wind speed. A new relationship between the friction velocity and the wind speed at 10 m was found; this new relationship contrasts with conventional deepwater expressions. The aerodynamic roughness depended not only on waves, as was expected, but also on atmospheric stability mainly associated with land breeze.
(2) The sea breeze produced a high-frequency peak in the nearshore wave spectrum that dominated the background swell in the afternoon and evening. The response of the wind waves involved amplitude, frequency and direction, whereas that of the swell was primarily limited to amplitude.
(3) Nearshore currents responded with a lag of 3-5 hours to the onset of the sea breeze cycle with current amplitudes of up to 25 cm/sec. As a consequence of the proximity of the coast and the surface slope associated with wind setup, these currents flowed essentially parallel to the shoreline and had only minor onshore-offshore components.
(4) Wave-induced currents around and inside the inner bar underwent systematic diurnal variations in response to offshore wave breaking and incident angles of the diurnal wave field, changing from closed circulations (early afternoon), to meandering currents (late afternoon), to weakly curved parallel currents (night and early morning).
(5) The beach system acted as a low-pass filter to input waves, so that both swash and groundwater fluctuations underwent high-frequency attenuation. The cutoff frequency varies as a function of the combined effects of the tide and diurnal wave field.
(6) Topographic response exhibited dependence on the scale of topography and excitation frequency. Whereas small-scale features such as ripples, megaripples, and beach cusps changed within an hourly or shorter time scale, large features such as crescentic bars and rhythmic shorelines on the order of 120 m in wavelength remained unresponsive for over three weeks.

D. Chemical Oceanography

1. Nutrients

In the marine ecosystem phytoplankton constitute the primary producers and as such are dependent on an adequate supply of three essential nutrients: nitrogen, phosphorous and silica. The primary sources of supply of these nutrients are upwelling of deep waters, advection and discharge from land sources (rivers and industrial and domestic sewerage). The primary process depleting the concentration of nutrients in the surface water is rapid uptake by phytoplankton and consequent removal of the phytoplankton by predation or by sinking. As a result, only low concentrations of nutrients are normally found in surface waters except in local source areas.

Major source areas of turbidities are the rivers and bay outlets into the Gulf of Mexico, principally the Mississippi and Rio Grande rivers. Organic content of the water is high bordering south Louisiana and Texas. A nutrient analyses of waters in the eastern Gulf of Mexico have recently been completed for the MAFLA baseline study, Fanning (1974). He reports on five of the most common dissolved nutrients (nitrate, nitrite, silica, phosphate and arsenate). Results show low surface and intermediate values and high bottom enrichment. Fanning (1974) rejects upwelling as the cause of the bottom enrichment and favors this enrichment from release of the nutrients from bottom sediments through diffusion or seepage. Manheim (1974) points out that the intermediate and surface nutrient values could be caused by uptake by benthic algae.

2. Salinity

The salinity patterns of the Gulf of Mexico (Fig. II-16) are principally determined by: inflow of ocean waters through the Yucatan Strait, precipitation and inflow of fresh water from land sources, evaportation, circulation and mixing and outflow through the Straits of Florida. In the northern Gulf, runoff from the Mississippi, Atchafalaya and from smaller rivers to the east and west gives rise to a band of low-salinity water (Nowlin, 1972). Seasonality is known to strongly influence nearshore-offshore salinity gradients.

In the upper 50 m, water in the central Gulf of Mexico typically has a salinity of very near 36.0 parts per thousand (ppt) (Leipper, 1954). The distribution of surface salinities in the winter is generally lower. A similar distribution pattern, but with generally higher salinities because of high evaporation rates, is found for summer conditions. In the eastern Gulf these distributions are modified by the seasonally dependent Loop Current (Sackett, 1972).

3. Trace Metals

The trace metals that usually occur in the marine environment include cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, iron, uranium and zinc. These occur in concentrations normally less than one part per million (ppm). These metals can enter the marine environment through weathering of rocks or by pollution discharge caused by human activities.

Analyses of sediments to determine concentrations of heavy metals were made by the U.S. Geological Survey for the South Texas OCS (Berryhill, 1975). The following conclusions have been drawn from this study.

As a regional pattern, the trace metals content of sediment in estuaries are relatively higher than in the sediments of the continental shelf.

Compared to the average trace metals content for the south Texas OCS as a whole, only cadmium and manganese are significantly high. For several trace metals, including cadmium, the highest concentrations are in the area of suspected gas seeps along the outer edge of the shelf in the northeastern part of the OCS.

The suspected gas seeps appear to be emanating upward along fault planes and may be depositing trace metals in the sea floor sediments, thus explaining the higher concentrations of some trace metals there.

In the south Texas OCS, the average levels for all trace metals determined are lower than the average levels for the segment of the northwestern Gulf shelf immediately to the north. For the overall northern Gulf of Mexico continental shelf, the average levels within the south Texas OCS are comparable.

A most intensive study of trace metals in the Gulf was completed by Corcoran (1972) for six trace metals: Cd, Pb, Cu, Cr, Zn and Mg. Except for copper, the concentration of the five other metals was ten times the concentration typically observed in open ocean waters. Also, manganese was higher than concentrations reported by Rona, et al. (1962). This seems to indicate enrichment of trace metals by the Mississippi River and from Escambia and Perdido Bays. The most complete

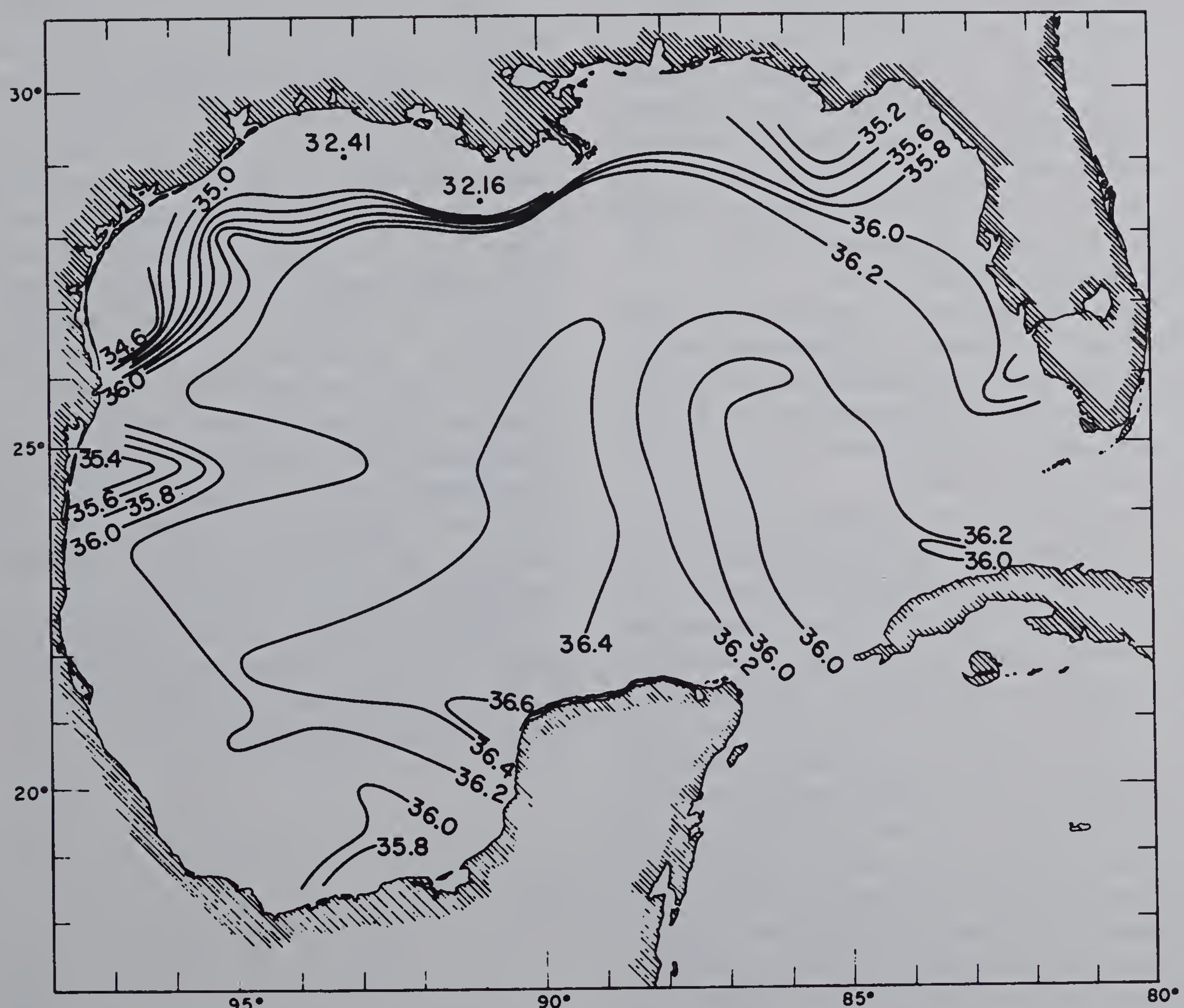


Figure II-16 Typical surface salinities (parts per thousand) in the Gulf of Mexico (Nowlin, 1972).

data on Alabama's coastal area was compiled by May (1973) from water samples collected in Mobile Bay and Gulf waters within six miles of offshore Alabama.

Trace metals were most recently determined in conjunction with MAFLA investigations for the central and western Gulf of Mexico (Florida Board of Regents, 1976). Results are summarized in Table II-3. Areas IV and V represent findings on metal concentrations offshore from Alabama and Mississippi. These studies along with those by Hood (1963), Rona, et al. (1962), Moritas (1961) and Slowey and Hood (1969) indicate that coastal waters have an order of magnitude greater concentration than open ocean waters.

When adequately sampled it appears that trace metal data can complement or reinforce circulation information and can indicate dynamic characteristics. Evidence of this is discussed in *A Summary of Knowledge of the Eastern Gulf of Mexico* (Jones, et al., 1973) as follows:

An examination of the distribution of trace metals in ESCAROSA (Escambia-Santa Rosa counties) indicates that water movements are complex. There seems to be a general movement of surface waters from east to west. Salinity, silicate and manganese data indicate a surface flow of water out of the bays, yet the trace metal data show an offshore enrichment with no apparent surface connection. This would indicate that the trace metals are carried below the surface upon their entrance into the Gulf, only to rise again a few miles away in small divergent areas, or they are entrapped within the bays and their offshore enrichment comes from the Mobile Bay and Mississippi River sources, or the surface waters are enriched by wind-carried aerosols. Possibly all three processes contribute. Sediment studies seem to indicate bay entrapment, but it is also well known that trace metals are released from sedimentary particles upon contact with saline water, and it is also well known that trace metals (especially lead) are constituents of the aerosols.

Slowey and Hood (1969) have reported high trace metals content at intermediate depths in Gulf water. They found this metal content at intermediate depths to decrease as the water moved through the Gulf of Mexico and concluded the metal origin to be from outside the Gulf, either from residual sub-Antarctic intermediate water, or from a continual rain of decaying organisms with their resultant release of metals during the northward transit of the water. The outside origin of high metal content of intermediate water seems reasonable and feasible. However, the conclusion is based on the resemblance of copper, manganese and zinc distributions in the Gulf to those found at one station taken from Cuba.

A map of trace metals for the Gulf of Mexico sediments has been proposed by Holmes (1973) from a semiquantitative analysis of sediment samples taken mainly from NMFS Geronimo cruises. Holmes (1971) has prepared a detail map of zirconium distribution in the northwestern Gulf from Galveston to beyond the Flower Garden Banks, Figure II-17. His analyses indicate that the highest trace-element concentrations are in regions of the shelf that are actively receiving sediments. The zirconium concentrations are an exception because they are deposited in areas of slow deposition along the elongate bathymetric features in offshore Texas. This correlation of zirconium concentration to the elongated features suggests that the topographic features are ancient shorelines that have been submerged during the past Pleistocene rise in sea level.

A further discussion of the occurrence of heavy metals in coastal regions can be found in Appendix 9, OCS Sale No. 40, Final EIS, Vol. 3, pp. 662-669 (USDI, BLM, 1976).

Table II-3. Sediment heavy metal concentrations (from Presley, _et al_.). N - number of samples. Standard deviation in parentheses.

Area	N	Fe (%)	Cd (ppm)	Cu (ppm)	Cr (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Ba (ppm)
I	9	.16 (.04)	<.05 (0)	4 (.6)	18 (5.4)	2 (1)	6 (1.3)	5 (1.5)	49 (15)
II	8	.16 (.08)	<.07 (.02)	4.4 (1.3)	13 (6.8)	3 (1.5)	3.5 (1.8)	6 (4.5)	46 (12)
III	20	.52 (.19)	<.09 (.05)	4.9 (2.7)	19 (7.5)	4.5 (1.9)	6 (1.6)	10 (4)	68 (31)
IV	10	.66 (.51)	<.08 (.03)	4.5 (3.8)	16 (20)	4 (2.7)	7 (2.7)	13 (7)	76 (39)
V	10	2.01 (1.11)	.2 (.08)	10.5 (7.1)	39 (23)	17 (13)	13 (6.5)	56 (37)	339 (213)
Carbonate rocks		.4	0.0	14	11	12	8	15	150
Nearshore sediments		3.5	0.0	48	100	55	20	130	750

Source: Florida Board of Regents, 1976.

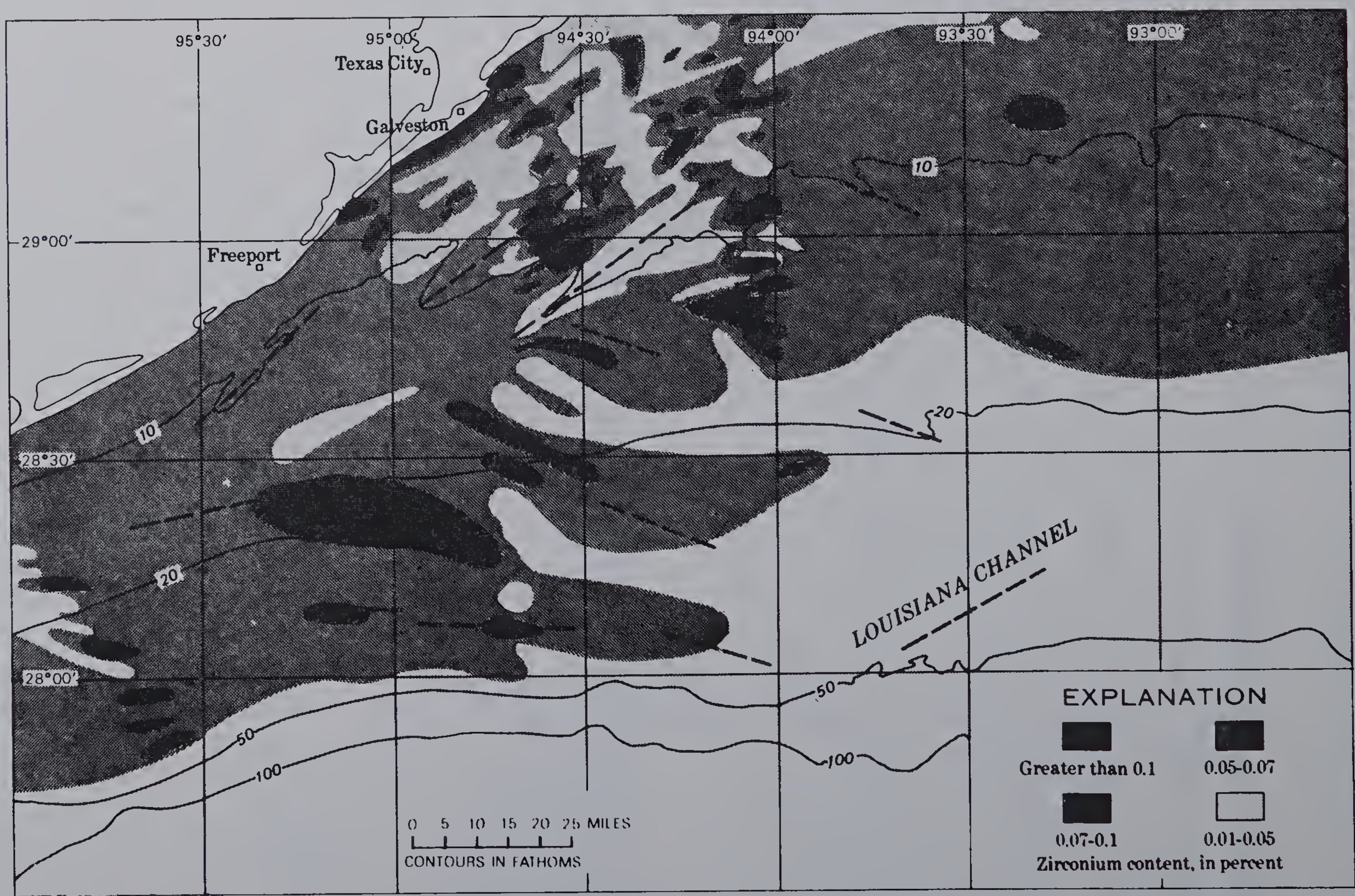


FIG.II-17 Distribution of zirconium in the central part of the northwest Gulf of Mexico shelf. Dashed lines approximate the axes of the topographic ridges

SOURCE: HOLMES 1971

E. Biological Communities

1. Phytoplankton

Phytoplankton sampling in the northern Gulf of Mexico has been sparse, intermittent, and mostly unquantitative. Much of the information on species comes from the reports of Balech (1967), and Steidinger (1973). These studies pertain only to the presence of certain species in given areas. Thus, it is difficult to recognize seasonal fluctuations or geographic shifts in phytoplankton abundance or species succession (Pequegnat, et al., 1976).

One recent attempt to put together information available at the time is Folio 22 of the American Geographical Society (El-Sayed, et al., 1972) which relies on the above mentioned works and Balech's (1967) report to plot distributional patterns of the most common phytoplankton. The report, however, largely leaves out numbers and seasonal distribution of the organisms.

In comparison with other data recorded for different parts of the Gulf the total cells per liter listed in this work are comparable. As might be expected the Eastern Gulf is a somewhat more productive area. Saunders and Glenn (1969) found a decrease from an annual average of 1.1×10^6 cells per liter at the shore to 8.5×10^3 cells per liter off the western coast of Florida. Under normal circumstances diatoms greatly outnumber the dinoflagellates (Steidinger, et al., 1967; Steidinger and Williams, 1970). Saunders, et al. (1967) reports at least a dozen species exceeding 1.0×10^6 cells per liter close to Florida's west coast. Hulburt, et al. (1960) recorded cell counts of 1×10^3 to 2×10^6 cells per liter in the Sargasso Sea. The most dominant organisms found there, a coccolithophorid (*Coccolithithus huxleyi*), was seen in the samples but was never very numerous. This corresponds with Hulburt's and Corwin's (1972) observation that a change from a coccolithophorid dominated flora to one dominated by diatoms occurs in the shallower water over the continental shelves (Van Baalen, 1976).

For the Texas Continental Shelf, Van Baalen (1976) reported the following:

> Yearly averages along the Texas transects were 4.1×10^5 cells per liter at the inshore stations, 7.8×10^4 at the middle stations, and 2.6×10^3 offshore. The yearly averages were greatly affected by the very large numbers found during the spring. The spring average for all stations and depths was 4.7×10^5 cells per liter. The summer and winter averages were 1.1×10^4 and 4.9×10^3, respectively. The summer average is a little misleading because of large counts at a couple of inshore stations. More than half of the stations (14) during the summer cruise showed less than 1,000 cells per liter. Winter samples on the other hand were consistent with very little variation from inshore to offshore.

Approximately 35 species and 26 genera of phytoplankton were identified in an area offshore Louisiana that was studied during the planning of the deepwater port (LOOP, 1975); this area is approximately 69 km (43 mi) west of the mouth of the Mississippi River. It was not possible to characterize any of the offshore areas sampled based upon known salinity preferences of the species found. While marine species were observed at almost all sampling stations, estuarine species were also found in the same samples, indicating the variability of the area and a strong influence of freshwater sources on the biota.

A definite phytoplankton seasonality was indicated in the LOOP studies. The predominant species observed from all stations during the late spring and summer months of 1973 consisted of the dinoflagellate genera of *Deratium*, *Exuviella*, *Gonyaulax* and *Gymnodinium*, while dominant diatom genera were *Asterionella*, *Biddulphia*, *Coscinodiscus*, *Cyclotella*, *Lithodesmium*, *Navicula*, *Pleurusigma*, *Surirella*, *Skeletonema*, *Stauroneis and Thallasiosira*.

Total phytoplankton density in samples of the study area ranged from zero to 30.5×10^3 cells per liter. The number of cells from the inshore stations was substantially greater than those from the offshore sites.

Offshore abundance levels of phytoplankton were greatest during June through August and lowest during the months of October through March. At the inshore stations the periods of greatest abundance were during October through March, while the periods of lesser abundance were during May through September.

The data from the offshore study area were collected during a period when the Mississippi River had been at flood stage twice within 13 months, and when (in the winter of 1974) extensive dredging operations were being conducted at Southwest Pass. These two factors no doubt affected the nutrient concentrations and turbidity of the offshore stations, and may have resulted in less than typical results. Primary productivity could be inhibited or greatly reduced by increased turbidity, because only after the turbidity decreased would phytoplankton be able to respond to nutrient loads received from the river discharge.

2. Zooplankton

Zooplankton comprise a major link between producers and higher trophic levels in the offshore Gulf waters. The most abundant groups found (copepods) and many other zooplanktonic crustacea seem capable of ingesting both phytoplankton and detritus particles, and thus are highly important in converting energy to biomass in higher level organisms (LOOP, 1975).

During the LOOP (1975) studies, copepods were the most abundant members of the zooplankton population offshore in all sampling months, making up between 52 to 97% of the monthly totals, with an average of 79%. *Acartia* was the most numerous copepod genus at all sampling depths and its representation was rather constant at each depth. Overall, this crustacean made up 53% of the copepod population. It was followed in abundance by *Paracalanus* which comprised 28% of the copepods sampled. Other important genera include *Oithona*, *Centropages*, *Eucalanus*, and *Labidocera*.

Additionally, meroplankton (especially crustacean larvae) made up a significant portion of some samples of zooplankton, but in most cases they were 10% less of the total. Post-larvae of shrimp were encountered in small numbers during most monthly samples. The mean number of zooplankton was 23/1 (Ragan, 1975). It is unknown whether this value is truly representative of offshore plankton populations because it differs somewhat from other sampling studies (LOOP, 1975).

Park (1976) reported the following for the South Texas continental shelf during his investigation for BLM: On the basis of 144 samples collected during three seasons, the zooplankton of the South Texas continental shelf waters were investigated to determine their abundance in terms of biomass and showed a consistent decrease seaward. This decrease was particularly pronounced in the spring and summer months when the zooplankton production was high at the shallow stations. This correlated with what was reported by LOOP (1975) and SUSIO (1976). The seasonal change of the zooplankton in both biomass and species composition was progressively extensive from the deep to shallow stations. Copepods were the most abundant group, comprising about 70% of the zooplankton by number. A total of 182 species of copepods were found, of which *Paracalanus indicus*, *P. quasimoto*, and *Clausocalanus furcatus* were most abundant.

3. Nekton

Nekton for the offshore waters are represented by five major taxonomic categories - marine mammals, reptiles, fishes, cephalopod molluscs (octopuses and squid) and certain crustaceans (shrimp and swimming crabs), (General Gulf, Visuals Nos. 4 and 5). Individuals of this group commonly but not always, range over broad areas, thus participating in several biotic communities. However, most nekton are limited in geographic and vertical ranges by the same environmental conditions as less mobile organisms, i.e., temperature, salinity, available food, and types of bottom.

The nekton component of the environment can be divided into strictly open water nekton, and nekton which at some stage of life are directly dependent upon estuarine or coastal ecosystems. Many of the finfish of commercial and sportfishing importance are strictly offshore residents, such as snappers, groupers, sail-fish, and marlin. Of particular importance from commercial and sport fishing standpoints are the semi-catadromous species which are spawned in open water, move inshore to bays and estuaries for their juvenile stage and return to deeper waters as adults.

Several biologists who have worked in the northern Gulf of Mexico have called attention to the presence of mainly warm-temperature or subtropic assemblages rather than tropical or Caribbean biota. The fauna is comparatively rich and includes many species that are not found elsewhere.

Less is known about offshore than inshore fishes, although offshore species seem more abundant but less diverse and seasonally variable.

Off the Louisiana coast trawl sampling was utilized to determine species composition and biomass for demersal fish and invertebrates (LOOP, 1975).

An average of 55 species of fish were collected in monthly trawl samples, with a total of 103 species. Numerically, the most important fish species were sea catfish (*Arius felis*), Atlantic croaker (*Micropogon undulatus*), rock sea bass (*Centropristes philadelphica*), cutlass fish (*Trichiurus lepturus*), fringed flounder (*Etropus crossotus*), spot (*Leiostomus santhurus*), bluespotted searobin (*Prionotus roseus*), sand trout (*Cynoscion arenarius*), gulf butterfish (*Peprilus burti*), and Atlantic bumper (*Chloroscombrus chrysurus*).

Offshore stations showed slightly heavier catches of Atlantic croaker, bay anchovy, cutlass fish, and bluespotted Sea robin than did onshore stations. Sea catfish showed the opposite pattern of abundance, being highest in inshore catches.

Of the invertebrates, decapod crustaceans were most abundant, including three species of commercial shrimp, followed by gastropods and pelecypods. The total number of invertebrates taxa collected per month (stations combined) ranged from 8 to 24, and approximately 43 taxa were collected over the entire sample period (LOOP, 1975).

A predominant invertebrate in the samples was the inshore squid, *Loliguncula brevis*. This species led all others on a number and weight basis at all but the deepest station. Squid contributed about 15% by number and 17% by weight to the invertebrate catch, but was two to four times greater in offshore than inshore locations. The crab, *Callinectes similis*, was the second most important invertebrate. Other invertebrates that were important included the blue crab (*Callinectes sapidus*), rock shrimp (*Sicyonia* sp.), and mantis shrimp (*Squilla* sp.).

The species composition of bottom fish showed a marked change with depth. The sea catfish was the most common species out to a depth of about 20 m, and the cutlass fish was most common at stations farther offshore. Atlantic croakers were plentiful at the offshore depths, but negligible between inshore and offshore depths. The bluespotted searobin was abundant at the deepest stations while the bumper, a pelagic species, was frequently found at the shallower studies (5 to 15 m); results at the deeper end of this range may have been due to the relatively greater height of the trawl in relation to the shallow bottom in the inshore stations. Other stations have shown the longspine porgy to be an important deepwater species of finfish but this species was only negligibly present in the LOOP study. A diminutive species, the bay anchovy (*Anchoa mitchilli*) was the most abundant fish at three of the four LOOP stations. The contribution of this species to total weight of the catches was minor due to the small size of these fish.

In bottom waters of the study area, oxygen level was a major influence on fish catches; other factors are depth and distance offshore. There is little doubt that a cause and effect relationship does exist between low oxygen levels and reductions in the number and weight of fish caught.

A similar study conducted by Chittenden and McEachran (1976) for the Northwestern Gulf of Mexico with major emphasis on the Texas Continental Shelf, reported the following: two major communities of demersal fishes are found over soft bottom on the continental shelf in the northwestern Gulf of Mexico inshore of the 91 m contour: 1) a white shrimp grounds located at about 3.5-22 m, and 2) a brown shrimp grounds located at about 22-91 m. The faunas of the two shrimp grounds were distinct at the family level except that a zone of faunal overlap occurred at 18-36 m. Most species that were abundant on one shrimp grounds were absent or virtually absent on the other. The fish communities were structually similar on the two shrimp grounds in that a single species and family dominated each community. These were Atlantic croaker and the family Sciaenidae (drums, croakers and seatrout) on white shrimp grounds, and Longspine porgy and the family Sparidae on the brown shrimp grounds. The fauna was richest in the cold months, especially on the brown shrimp grounds. The fishes of the white shrimp grounds have a strong affinity for estuaries whereas the fishes of the brown shrimp grounds are independent of estuaries.

Relative biomass was much higher on the brown shrimp grounds than on the white shrimp grounds. Relative biomass was much higher in summer than during winter, especially on the white shrimp grounds.

Members of the nektic assemblage ranging over broad areas of the pelagic environment include squid and the schooling fishes, such as the amberjack, crevalle jack, horse-eye jack, bluefish, king mackerel, various anchovies and herrings, and menhaden. Several types of pelagic fishes do not travel in schools, but rather roam alone or in small groups. These types include the cartilaginous fish, the sharks, and the bony fish, such as Atlantic sailfish, and blue marlin.

Certain oceanic fish visit the shelf waters during the summer months. These include the mackerels, bonito, amberjack, blue runner, dolphin and a number of billfishes and other species of sport and commercial interest. These wide-ranging, fast-swimming predatory fishes are often caught within sight of shore, especially around the mouth of passes where they feed on anchovies, silversides, squid, shrimp, and bottom fishes.

Studies by Bright & Cashman (1974), Causey (1969), Walls (1973) have been conducted concerning the fish fauna of offshore banks (hard substrates) of the northern Gulf of Mexico, another study has been directed towards studying the fish fauna of offshore oil platforms. Sonnier, et al. (1976) made observations, photographs and collections of fishes on the western reefs of the outer Louisiana continental shelf and around oil platforms and verified the presence of an extensive tropical fish fauna. Of 105 species recorded, about 50% were tropical species either unreported or rarely reported from the northwestern Gulf of Mexico. More species were found around reefs than oil platforms, although a number were common to both (Table II-4) and 12 species were found only around platforms (Table II-5). The 67 species of fish found at the deeper reefs were all typical Caribbean-West Indian species. No estimate concerning biomass between the two sides of the Gulf of Mexico has been reported.

Sonnier, et al. (1976) found that platforms generally show a lesser growth of epifauna than the reefs, suggesting fewer niches. This estimate of 49 species occurring on platforms and 93 species on the reefs also reflects platforms studied were inshore of the deeper reefs and subject to greater water temperature fluctuations.

4. Benthos

The benthic communities for the OCS can be broadly described as shallow, intermediate and deep shelf assemblages, and slope assemblages. Within these broad areas, more specific assemblages can be described for shrimp grounds, oyster grounds, sand bottoms, silt and mud bottoms, rocky bottoms, and hard banks. For location of these bottom types see the following visual graphics: Bottom sediments-Visual No. 3; Undersea features-Visual No. 4; Coastal zone and offshore Visual No. 5; Migration of Gulf of Mexico penaeid shrimp and main fishing grounds-General Gulf, Visual No. 5.

The organisms are generally distinct for each of the three neritic zones (supratidal or supralittoral; intertidal or littoral, and subtidal or sublittoral) but specific species may be found in more than one zone. Zonation is characterized more by dominant species than by distinct assemblages of numerous species.

The main benthic floral groups are the seagrasses and the benthic algae, (General Gulf Visual No. 3). The outer limits of the seagrasses define the inner limit of the offshore environment for this discussion. The benthic algae predominantly inhabit rocky coastlines and hard bottom areas. The capacity of such habitats in the Gulf of Mexico region allows the seagrasses to dominate the benthic algae. Representatives of the four major phyla of algae (cynophyta, blue-green; Rhodophyta, red; Phaeophyta, brown; Chlorophyta, green) may be found in suitable locations, but in offshore waters, red and brown algae predominate (Odum, 1971). In exceptionally clear waters, benthic algae are known to grow in at least 183 m of water, especially coralline red algae, and apparently green, brown, and non-coralline red algae as well (Humm, 1973). Locally, in depths of 18-91 m there may be extensive bottom cover of algal nodules, fist-sized and larger spheriodal aggregations or coralline algae and carbonate debris (Logan, 1969).

The epifaunal representatives offshore include almost all animal phyla. They range from the sessile organisms like sponges and anemones to the slower moving forms such as shrimp and crabs to the highly motile demersal fish. Demersal fish include the commercially important species such as: flounders, red snapper, croakers, groupers, etc.

The most important commercial epifaunal species for the Gulf of Mexico are the brown shrimp, (*Penaeus aztecus*), the white shrimp (*Penaeus setiferus*), sea bob (*Xiphopeneus kroyeri*) and the royal red shrimp (*Hymenopenaeus robustus*). Royal red shrimp are found in deep waters from 320 to 550 m.

5. Birds

Six endangered bird species occur within the zoogeographic region of this proposal (see Visual No. 4).

The endangered whooping cranes (*Grus americana*) winter on the Aransas National Wildlife

Table II-4. Species Occurring Both at Platforms and Reef Areas Samples

Species	Reef Area A	Reef Area B	Reef Area C	Platforms
Dasyatis americana - Southern Stingray	C [1/]	C	C	R
Epinephelus adscensionis - Rock hind	C	C	C	0
E. itajara - Jewfish	R			C
Mycteroperca phenax - Scamp	C	C	C	C
Apogon maculatus - Flamefish	C	C	C	0
Rachycentron canadum - Cobia	0			C
Caranx hippos - Crevalle jack	C	C	C	C
C. latus - Horse-eye-jack	C	C	C	C
Elagatis bipinnulata - Rainbow runner		0	C	R
Selene vomer - Lookdown	C	0		C
Seriola dumerili - Greater amberjack	C	C	C	C
Lutjanus campechanus - Redsnapper	C	C		C
L. cyanopterus - Cubera snapper	R			R
L. griseus - Gray snapper	R			R
Rhomboplites aurorubens - Vermilion snapper	0	C	C	0
Haemulon aurolineatum - Tomtate	C			0
Archosargus probatocephalus - Sheepshead	R			C
Equetus umbrosus - Cubbyu	R			R
Kyphosus sectatrix - Bermuda chub	C	C		C
Chaetodon ocellatus - Spotfin butterfly fish	0	0	0	0
Holacanthus bermudensis - Blue angel fish	C	C	C	C
H. ciliaris - Queen angelfish	0	0	0	0
H. tricolor - Rock beauty		0	0	R
Pomacanthus paru - French angelfish	C	C	C	C
Pomacentrus variabilis - Cocoa damselfish	C	C	C	C
Amblycirrhitus pinos - Redspotted harwfish		0	0	R
Bodianus pulchellus - Spotfin hogfish			0	0
B. rufus - Spanish hogfish	C	C	C	R
Thalassoma bifasciatum - Bluehead	C	C	C	0

1/ C = Common
0 = Occasional
R = Rare
(Source: Sonnier et al., 1976

Table II-4 (continued)

Species	Reef Area A	Reef Area B	Reef Area C	Platform
Sphyraena barracuda - Great barracuda	C	C	C	C
Scomberomorus cavalla - King mackerel	C			C
Aluterus scriptus - Scrawled filefish			R	R
Balistes capriscus - Gray trigger fish	C	C	C	C
B. vetula - Queen triggerfish		R	O	R
Cantherines pullus - Orange-spotted filefish		R		O
Canthidermis sufflamen - Ocean triggerfish	O	C	C	C
Canthigaster rostrata - Sharpnose puffer	O	O	O	O
Totals	30	28	25	37

Table II-5. Species Primarily Associated with Platforms

Species	
Epinephelus nigritus - Warsaw grouper	C [1/]
Rypticus maculatus - Whitespotted soapfish	C
Caranx crysos - Blue runner	C
Chloroscombrus chrysurus - Atlantic bumper	R
Vomer setapinnis - Atlantic moonfish	R
Ocyurus chrysurus - Yellowtail snapper	O
Chaetodipterus faber - Atlantic spadefish	C
Pomacanthus arcuatus - Gray angelfish	R
Hypleurochilus geminatus - Crested blenny	C
Acanthurus coeruleus - Blue tang	R
Aluterus schoepfi - Orange filefish	R
Monacanthus hispidus - Planehead filefish	C

1/ C = Common
O = Occasional
R = Rare
(Source: Sonnier et al., 1976)

Refuge along the south central Texas coast and a critical habitat area has been established around this refuge.

A migration route for the endangered American peregrine falcon (*Falco peregrinus*) traverses the coastal area and barrier islands of south central Texas. The endangered Attwater's greater prairie chicken (*Tympanuchus cupido attwateri*) inhabit the coastal prairie of south central Texas.

Endangered southern bald eagles (*Haliaetus 1. leucocephalus*) inhabit the coastal marshes of south central Texas and a few eagle nests are found in Terrebonne, St. Mary, Jefferson, and St. Charles parishes of Louisiana.

The endangered brown pelican (*Pelecannus occidentalis*) nesting areas occur along the south central Texas coast and on Queen Bess and Grand Terre Islands in Louisiana.

A small portion of the endangered Mississippi sandhill crane (*Megalornis mexicanus*) are found in Jackson County, Mississippi.

The beaches and coastal marshes of this central Gulf of Mexico region are also inhabited by migrant and non-migrant bird species such as: plovers, sandpipers, curlews, loons, coots, gulls, herons, ibis, and egrets (see Table II-6).

The pelagic birds listed in Table II-6 (jaegers, gannets, shearwaters, boobies, frigates, terns, petrels, and noddies) all occur in the Gulf of Mexico region (Murphy, 1967). However, the majority of these species are rarely observed from land and their numbers are unknown.

Seabird rookeries of the least, sandwich, royal, caspian and Forster's terns are found along the Louisiana (Breton, Chandeleur, and Tern Islands) and Mississippi (Cat, Ship, Horn and Petit Bois Islands) Gulf coast areas.

Colonial nesting and wading bird colonies (herons, egret, and spoonbill) are dispersed throughout the western and central Gulf of Mexico coastal areas. A white pelican nesting site is located on the northwest portion of Padre Island, Texas (see Visual No. 4).

Several species of waterfowl (mainly Gadwall, teal, pintail, mallard, and wigeon—Table II-6) utilize the Central and Mississippi Flyways as they migrate into the western and central Gulf of Mexico coastal areas. Migrant waterfowl over-winter in these areas; their numbers start increasing in early October and increase steadily reaching a peak in December. An estimate of the over-wintering population for this region may range from four to six million ducks and geese.

6. Marine Mammals

The marine mammal fauna of the Gulf of Mexico consists mostly of cetaceans (whales, dolphins, and porpoises). The two other groups, pinnipeds (seals and sea lions) and sirenians (manatees) are found infrequently in the area. Table II- 7 lists the species, their population, migration, distribution and primary food in the Gulf of Mexico.

The Marine Mammal Protection Act of 1972 was established to protect all marine mammals in territorial waters of the U.S. (including imported marine mammals and products).

Schmidly and Melcher (1974) have documented 16 species of cetaceans near the Texas coast. The most common smaller cetaceans are the bottlenosed dolphin (*Tursiops truncatus*) and spotted dolphin (*Stenella plagiodon*). The sperm whale (*Phipetu catadon*) and pilot whale (*Globicephala macrorhyncha*) are the most common cetaceans.

The bottlenosed dolphin is considered an inshore species and its offshore range rarely exceeds the limits of the continental shelf. A survey of Gulf shrimpers indicates that little change has occurred in the numbers of dolphins over the past 10-20 years. It was also suggested that larger dolphins move offshore during the winter, whereas, smaller dolphins are more common offshore during the summer.

Some of the larger whales occur far offshore in deep water and are seldom seen inshore. Some whale found in the Gulf are on the endangered list such as the Blue whale, Black right whale, Humpback whale, Sei whale and Fin whale (U.S. Dept. of Interior, 1975). No dolphins, pinnipeds or odontocetes known to occur in this region are considered endangered. Some of the whale species such as the antillean beaked whale, pygmy killer whale, goose beaked whale and blue whale are considered rare, not only in this region, but also worldwide.

7. Marine Turtles

Four species of marine turtles occur in the Gulf of Mexico: Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Atlantic Ridley (*Lepidochelys kempi*), and Leatherback (*Dermochelys coriacea*). Of these four species, the Loggerhead and the Green were recently designated as "endangered" (November 1976) by the Convention on International Trade in Endangered Species of Wild Fauna and Flora; the Leatherback and the Ridley

TABLE II-6 Selected Bird Species of the Gulf of Mexico Region

Common Name	Scientific Name	Habitat	Primary Food	Population Trend
Southern Bald eagle*	*Haliacetus leucocephalus*	freshwater areas	fish, ducks, rabbits, rodents	decreasing
Osprey	*Pandion heliaetus*	coastal bays and estuaries	fish	decreasing
American Peregrine falcon*	*Falco peregrinus*	coastal amd mountainous areas	small birds	breeding pop.
American oyster catcher	*Haematopus ralliatus*	marine coasts, tidal zones and beaches	oysters	increasing
Piping plover	*Charadruis melodus*	lake shores and sandy marine beaches	crustaceans and marine animals	decreasing
Wilson's plover	*C. wilsonia*	beaches, sand bars, mud flats and inlets	small mollusks and shrimp	decreasing
Great black-beaked gull	*Larus marinus*	beaches, harbors, and garbage dumps	fish	increasing
Ring-billed gull	*L. delawarensis*	lakes, seacoasts, and estuaries	insects, rodents, eggs	decreasing
Gull-billed tern	*Gelochelidon nilotica*	seacoasts and marshes	insectivorous	decreasing
Forster's tern	*Sterna forsteri*	fresh and saltwater marshes	fish and aquatic organisms	stable
Common tern	*S. Hirundo*	fresh and saltwater marshes	fish	stable
Least tern	*S. albifrons*	mud, sand and gravel beaches of estuaries and oceans	small fish	increasing
Black skimmer	*Rhynchops nigra*	seacoasts, lagoons, and barren sands	fish and crustaceans	decreasing

Table II-6 (continued)

Common Name	Scientific Name	Habitat	Primary Food	Population Trend
Pomarine jaeger	*Sterocorarius pomarinus*	open ocean	fish	unknown
Parasitic jaeger	*S. parasiticus*	open ocean	fish	unknown
Gannet	*Morus bassanus*	seacoast and open ocean	fish	unknown
Audubon's Shearwater	*Puffinus iherminier*	open ocean	fish	unknown
Sooty Shearwater	*P. griseus*	open ocean	fish	unknown
Blue-faced booby	*Sula dactylatra*	open ocean	fish and squid	unknown
Brown booby	*S. leucogaster*	open ocean	fish and squid	unknown
Frigate bird	*Fregata magnificens*	open ocean	fish and squid	unknown
Sooty tern	*Sterna fuscata*	open ocean	fish	unknown
Wilson's petrel	*Oceanites oceanicus*	open ocean	fish	unknown
Belted kingfisher	*Megaceryle alcyon*	fresh water and saltwater shores	fish	stable
Dusky seaside sparrow*	*Ammospiza nigrescens*	salt marshes	insects	decreasing
Common loon	*Gavia immer*	saltwater-winter; freshwater-summer	fish	stable
Brown pelican*	*Pelecannus occidentalis*	inshore saltwater bays, sandy beaches	menhaden	decreasing
Water turkey	*Anhinga anhing*	swamp and slow moving fresh and saltwater	fish and aquatic vegetation	decreasing
Limpkin	*Aramus guarana*	freshwater marshes	mollusks and crustaceans	decreasing
American Coot	*Fulica americana*	estuaries and bays	omnivorous	decreasing

Table II-6 (continued)

Common Name	Scientific Name	Habitat	Primary Food	Population Trend
Great blue heron	*Ardea herodias*	tree tops (nest), feed salt and freshwater	fish	stable
Green heron	*Butorides virescens*	fresh and saltwater	small fish	decreasing
Little blue heron	*Florida caerulea*	fresh and salt marshes, meadows	small fish and crustaceans	increasing
Noddy	*Anous stolidus*	open ocean	fish	unknown
Cattle egret	*Bubulcus ibis*	nest in brackish areas	orthopterous insects	increasing
Wood stork	*Mycteria americana*	fresh & brackish water	small fish	decreasing
Glossy ibis	*Plegadis falcinellus*	marshes - saltwater fresh	crayfish & insects	increasing
White ibis	*Eudocimus albus*	brackish & freshwater marshes	crustaceans	stable
Roseate spoonbill	*Ajaia ajaja*	brackish & freshwater marshes	aquatic crustaceans, insects & fish	stable
Mississippi sandhill crane*	*Grus canadensis pulla*	brackish & freshwater marshes	cultivated grains, aquatic insects & fish	decreasing
Wood duck	*Aix sponsa*	ponds, swamps & rivers	oak, hickory & duckweed	decreasing
Canvasback	*Aythya valisineria*	prairie potholes & freshwater	aquatic vegetation & clams	decreasing
Lesser scaup	*A. affinis*	saltwater bays & estuaries	plants & clams	decreasing
Ringnecked	*A. collaris*	brackish & freshwater marshes	aquatic crustaceans, insects & vegetation	stable

Table II-6 (continued)

Common Name	Scientific Name	Habitat	Primary Food	Population Trend
Red-breasted merganser	*Mergus serrator*	freshwater-summer & saltwater-winter	fish	decreasing
Mallard	*Anas p. platyrhynchos*	brackish & freshwater marshes	cultivated grains, aquatic vegetation & insects	decreasing
Gadwall	*A. strepera*	brackish & freshwater marshes	aquatic vegetation & seeds	increasing
American wigeon	*A. americana*	brackish & freshwater marshes	aquatic vegetation	increasing
Green-winged teal	*A. crecca carolinensis*	brackish & freshwater marshes	aquatic vegetation & seeds	increasing
Blue-winged teal	*A. discors*	brackish & freshwater marshes	aquatic vegetation & insects	decreasing
Northern shoveler	*A. clypeata*	brackish & freshwater marshes	aquatic vegetation, seeds, plankton & insects	increasing
Pintail	*A. a. acuta*	brackish & freshwater marshes	cultivated grains, aquatic vegetation & seeds	increasing
Mottled duck	*A. fulvigula maculosa*	bracksih & freshwater marshes	aquatic insects, crustaceans, & seeds	increasing
Lesser snow goose	*Anser c. caerulesceus*	coastal marshes agricultural fields	aquatic vegetation cultivated grains	decreasing

* Endangered

Source: Bellrose, 1976; Roberts, 1974; and Murphy, 1967.

TABLE **II-7.** Species of Marine Mammals Known to Occur in the Gulf of Mexico

Common Name	Scientific Name	Distribution	Occurrence	Population	Primary Food Source
*Sperm Whale	*Physeter catodon*	Offshore La., Ala., & Miss.	common	decreasing	squid, shark, and bony fish
Pygmy Sperm Whale	*Kogia breviceps*	Offshore Texas	rare	rare	squid
Dwarf Sperm Whale	*K. Simus*	Entire Gulf of Mexico	limited no.	stable	squid
*Black Right Whale	*Balaena glacialis*	Entire Gulf of Mexico	rare	increasing	zooplankton-copepods
*Humpback Whale	*Megaptera novae angliae*	Rare to the Gulf of Mexico, one siting offshore Florida	rare	increasing	
*Sei Whale	*Balaenoptera borealis*	Offshore Louisiana	rare	declining	krill, schooling fish; copepods
*Fin Whale	*B. physalus*	Offshore Texas and Louisiana	limited no.	stable	krill, squid, and small fish
False Killer Whale	*Pseudorca crassidens*	Offshore Louisiana	rare	stable	squid and large fish
Killer Whale	*Globicephala macrorhyncha*	Entire Gulf of Mexico	rare	stable	squid, sea turtles, sea birds and fish
Short-finned Pilot Whale	*Feresa attenvata*	Entire Gulf of Mexico	common	stable	squid and fish
Pygmy Killer Whale	*Ziphys cavirostris*	Entire Gulf of Mexico	rare	stable	squid
Goose-Beaked Whale		Offshore Louisiana	rare	stable	squid

Table II-7. (cont.)

Common Name	Scientific Name	Distribution	Occurrence	Population	Primary Food Source
Antillean Beaked Whale	*Mesoplodon europaeus*	Entire Gulf of Mexico	common	stable	squid
Risso's Dolphin	*Grampos griseos*	Entire Gulf of Mexico	common	stable	squid and small fish
Rough Toothed Dolphin	*Steno bredanensis*	Entire Gulf of Mexico	rare	stable	squid
Spotted Dolphin	*Stenella plagiodon*	Entire Gulf of Mexico	rare	stable	squid and small fish
Gray's Dolphin	*S. coeruleoalba*	Offshore Louisiana	limited no.	stable	squid and small fish
Bridled Dolphin	*S. frontalis*	Offshore Texas	uncommon	stable	squid and small fish
Spinner Dolphin	*S. longirostris*	Entire Gulf of Mexico	common	stable	squid and small fish
Saddleback Dolphin	*Delphinus delphis*	Entire Gulf of Mexico	common	stable	no data
Atlantic Bottle-Nosed Dolphin	*Tursiops truncatus*	Entire Gulf of Mexico	uncommon	stable	fish, squid and crustaceans
*Blue Whale	*Balaeonptera musclus*	Offshore Texas	uncommon	unknown	euphausiids
Minke Whale	*B. Acutorostrata*	Entire Gulf of Mexico	common	unknown	euphausiids and small fish
Bryde's Whale	*B. edeni*	Entire Gulf of Mexico	common	unknown	euphausiids and small fish
California Sea Lion	*Zalophys californianus*	Inshore Louisiana	rare	feral species	squid and small fish
*West Indian Manatee	*Trichechus namatus*	Louisiana Coastal Lakes	rare	few	aquatic vegetation

* Endangered species according to the Federal Register. 1975.

Source: Lowery, G. H. 1974. and Department of Commerce. 1976.

were already on this list. In addition, the Loggerhead and Green Turtles have been proposed for "threatened" status by the USFWS and NMFS, while the Atlantic Ridley and Leatherback are listed as "endangered" by USFWS under the Endangered Species Act of 1973.

Loggerhead Turtles nest on beaches of the Northern Gulf during summer months. Ogren (1976) observed this species in nesting activity on Errol and Chandeleur Islands. He also reported nesting observed by others on Cat, Ship and Horn Islands. Other offshore islands east of the Mississippi Delta may host a few nesting turtles. No nesting activity was observed west of the delta to Marsh Island, La., on aerial surveys conducted during the peak of the reproductive season. Some nesting by Loggerheads west of Marsh Island, La., may take place; however, aerial surveys are needed to substantiate this. Nesting has also been observed on St. Joseph Peninsula, St. Vincent, and St. George Island in Northwest Florida.

It has been reported that subadult green turtles have been captured by trot line fishermen in Laguna Madre, Texas.

The Atlantic Ridley is truly an endangered species. The number of nesting females has declined from over 40,000 in the 1940's to about 400-500 in 1976 (Archie Carr, personal communication). Any unnatural mortality of the surviving reproductive unit should be avoided. Although they nest in abundance only in Tamaulipas, Mexico, it is apparent that the Northern Gulf of Mexico coastal area (i.e. the shrimping grounds) is a primary forage area for this species which can be considered a "Gulf of Mexico" sea turtle.

The Atlantic Ridley and Leatherback Turtles have been recorded as nesting on Padre Island, Texas (Hildebrand, 1963). Hildebrand (personal communication) stated that the major feeding grounds for the Atlantic Ridley may be off Louisiana. Dobie et al. (1961) reported on the food habits of this species and confirmed Hildebrand's statement that portunid crabs (*Callinectes* sp.) made up a large portion of the diet of those specimens examined. Pritchard and Marquez (1973) reported captures of Atlantic Ridleys off Texas and Louisiana which were tagged at the Rancho Nuevo in Tamaulipas, Mexico.

Although a tropical nesting species, the Leatherback ranges widely throughout the Gulf of Mexico and Western North Atlantic as far north as Nova Scotia. Records of this species were reported for the Northern Gulf by Yerger, 1965. Many observations have been made of large numbers of Leatherbacks in inshore waters during this time of the year according to Ogren. They are usually associated with an abundance of jellyfish, upon which they feed and presumably follow. Prevailing southwest winds during this period seem to concentrate this food item in the nearshore zone.

8. Other Wildlife

The red wolf (*Canis rufus*) and American allligator (*Alligator mississippiersis*) are endangered species which inhabit the coastal areas of the central Gulf of Mexico.

The red wolf has historically inhabited the coastal prairie in Texas and southwest Louisiana (Cameron and Vermilion Parishes). Its present population status is unknown. The alligator inhabits most of the fresh water marshes and swamps of the central Gulf of Mexico. It depends upon well established marsh habitat for its supply of food and for successful nesting. The American alligator is considered an endangered species, except in Cameron, Vermilion and Calcasieu Parishes of Louisiana, where it is listed as threatened (FWS, 1976).

A unique population of white-tailed deer (*Odocoileus virginianus mcilhennyi*) exists in the delta marshes at the mouth of the Mississippi River. The population (150 to 200) fluctuates with the changing conditions of the delta habitat.

Nutria (*Myocaster coypus*), muskrat (*Ondatra zibethicus*), and raccoon (*Procyon lotor*) are important furbearers which inhabit the coastal marshes of the central Gulf. Pelts and meat from these animals produced an income over 13 million dollars during 1975-76 in Louisiana. (Louisiana Fish & Game Dept., 1977).

9. Biologically Sensitive Areas

Biologically sensitive reefal features adjacent to or contained in certain lease blocks for this proposed sale will be treated in the narrative below. Discussion on other reefal features may be found in preceding sections.

a. Flower Garden Banks; Texas

The following material is taken primarily from Bright, et al. (1976) with minor alterations.

The East Flower Garden is, biotically, the most diversified of the hard banks on the Texas-Louisiana continental shelf. Though its neighbor, the

West Flower Garden is quite similar and more thoroughly documented (Bright and Pequegnat, 1974), it apparently lacks some of the shallower biotic zones found at the East Flower Garden above 45 m, namely, the Leafy Algae Zone and *Madracis* Zone (Figure II-18).

Water clarity on the bank is exceptional, with visibility consistently exceeding 15 m and often 30 m. The main living coral reef (*Diploria-Montastrea-Porites* Zone) occupies the crest of the bank down to approximately 46 m depth. Most of the reeftop varies in depth from 18 to 28 m but 14 to 15 m depths are common, and an 11 m depth has been encountered.

Living corals cover 30 to 50% of the bottom where the reef is developed, and as at the West Flower Garden, the major reef builders are *Montastrea*, *Diploria* and *Porites*, probably in that order of importance. The Fire coral, *Millepora alcicornis*, encrusts reefrock throughout the zone as do various species of sponges and other epifauna.

Tract 45-50, High Island - East Addition - South Extension - Block A-374, is located to the northeast of the East Flower Garden and a portion of that block will be under a protective stipulation (see Section IV D.).

b. FISHING BANKS; LOUISIANA AND TEXAS

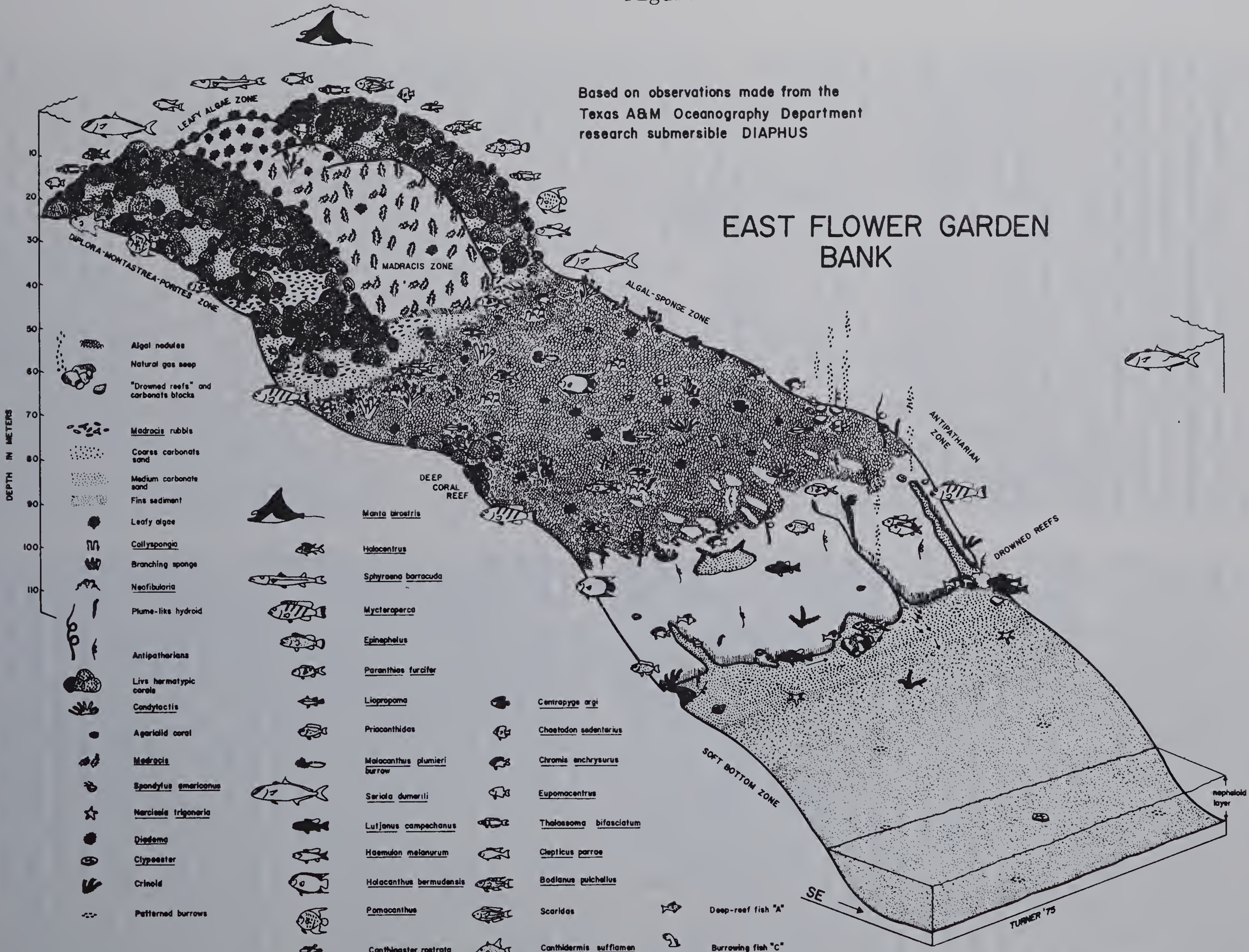
All fishing banks located in lease tracts in this proposed sale are not as well known as the East Flower Garden. The principal banks of concern for this discussion are those located offshore western Louisiana, see Visual No. 4. Sonnier, et al. (1976) stated that a number of rocky prominences are located offshore of Louisiana from the edge of the continental shelf inshore to within approximately 92 km of the coastline. These rock structures are occasionally very abrupt, located in depths ranging as great as 125-155 m with narrow pinnacles jutting to within 30 m of the water's surface. The origin of all of these pinnacles has not been proven, but it is generally conceded that they are caused by subsurface salt domes or other diapiric structures and associated faulting (Uchupi and Emery, 1968), and salt has been demonstrated from those at the shelf edge (Lehner, 1969). Parker and Curray (1956) have reported some invertebrates collected in dredges but most groups remain unstudied.

Largely because of their absence from current navigational charts and the lack of any intensive survey of the area, numerous similar structures have gone unstudied and remain virtually unknown. Such formations exist all along the Louisiana coast but they occur with greatest frequency between 90 and 94° W. longitude in water depths ranging from 24-185 m. The extent of the bottom expression varies greatly (Parker and Curray, 1956).

Juhl (personal communication) and Carpenter (1965) identified the above mentioned banks as productive snapper habitat. Carpenter (1965) stated that these areas have been a major source of snapper in the Gulf of Mexico since 1892.

Tracts of this proposed sale which may contain a portion of a fishing bank are:

Tract	Block	Bank
36	High Island Area 71	Sabine Bank
39	High Island Area 199	Heald bank
50	High Island Area, South Addition A374	East Flower Garden Bank
97	Ship Shoal 110	Ship Shoal



SOURCE: BRIGHT ET AL, 1976

F. Biological Environment of the Coastal Zone

Data on the biological environment of the coastal zone for the western and central Gulf has been treated in previous environmental statements prepared by the Bureau of Land Management.

Reference to the following environmental statements is suggested for a more detailed discussion on the biological environment and communities of the coastal zone.

Louisiana - Final Environmental Statement, Vol. 1, OCS Sale No. 36, pp. 122-198.
Texas - Final Environmental Statement, Vol. 1, OCS Sale No. 37, pp. 137-175.
Gulf of Mexico General Lease Sale - Final Environmental Statement, Vol. 1, OCS Sale No. 41, pp. 132-147.

The direct distance along the arc of the Texas coastline between its political boundaries is roughly 595 km. The extent of mainland shoreline, however, as described along its many dendritic bays, is approximately 2,896 km. Eight major bay systems penetrate the Texas coast, and all except the Sabine River estuary are fronted by a portion of a 483 km chain of barrier islands and peninsulas. The uniqueness of this coastal barrier is twofold: It is the longest barrier island system in the world and is comparable in magnitude to the Great Barrier Reef off western Australia; and less than a dozen inlets and passes provide the narrow arteries for exchange between the embayed waters and the open sea.

The seaward margin of the Texas coast, comprised mostly of barrier islands, is a nearly continuous strand of sand beaches. Shoreward of the beaches is the man-made Intracoastal Canal which courses the entire length of the coast. The area of coastal marsh is roughly 1,611 km^2, but is limited to a narrow band along the coast with its greatest extent in the Sabine area and then dimishes southward.

The Mississippi contributes nutrients to most of the estuaries of Louisiana - the most extensive in the Gulf - which support the third largest shrimp production and the second largest oyster production in the U.S. (U.S. Dept. of Commerce, 1974).

East of the Mississippi Delta, the proportion of estuaries to the coastal zone diminishes and becomes more commonly characterized by high energy sand beaches. Wetlands, estuaries, marshes, swamps, and bays are extremely productive areas. In terms of energy, most of these areas are more productive than the most productive commercial farming areas, acre for acre.

The paramount feature of this area of the Gulf Coast is the Mississippi River Delta containing approximately 72.8 million hectares of marsh and estuaries. The marshes of this geographic area are depicted in Visual No. 6. The Mississippi River watershed covers about one-third of the United States, and the resultant freshwater discharge is responsible for the major saltwater dilutions within the central Gulf Coast region.

1. Salt Marsh

Most salt marshes exhibit distinct zonation of the most abundant plants. This zonation is controlled by a variety of factors including soil types, soil salinity, tide, elevation, drainage characteristics, and pH. The extent of saline intrusion into the marsh depends to a large degree on the rate of percolation (movement through soils) of saltwater at high tide (Jackson, 1952), and the location of points of influx of freshwater from the mainland. In the vicinity of the Mississippi Delta, the saline marsh is generally adjacent to the beach rim and may vary from 2 to 24 m in width.

The comparatively small number of plant species of the saltmarsh limits the number of available niches in which organisms may live. Chabreck (1972) recorded only 17 plant species present in the coastal saltmarsh of Louisiana, with saltmarsh cordgrass (*Spartina alterniflora*) being the dominant species. However, with the inland marsh succession, habitat complexity increases significantly.

Salt marsh grass (*Spartina alterniflora*) comprises the most seaward of the vegetation zones where it endures the deepest and longest inundation by salt water. Black rush (*Juncus roemerianus*) inhabits the next zone inland and therefore occurs on slightly higher ground. This species forms almost pure stands to heights of 1.8 to 1 m and functions to slow down tidal penetration. The third zone inland is dominated by salt grasses (*Distichlis spicata* and *Spartina patens*). This zone is rarely inundated except during high tides.

Salt marshes support considerable populations of rails, sparrows, ducks, numerous shorebirds and a few reptiles. The area also functions as a hatchery for fish and invertebrates which are essential to the maintenance of the higher vertebrates.

2. Brackish Marsh

Brackish marshes are usually situated between the seaward salt marsh and landward intermediate and fresh water marshes. These brackish marshes are located extensively in southeastern Texas and the coast of Louisiana.

Salinities vary annually between an average low of 3.4 ppt (parts per thousand) to an average high of 16.7 ppt. Highest salinities occur in June, or in the drought period (Palmisano, 1971).

Plant species diversity increases as one approaches the upland environment from the marsh. Forty species of plants (Chabreck, 1970) have been recorded in the brackish marsh. The dominant species wiregrass, (*Spartina patens*), comprises 55% of the total vegetation. Saltgrass, (*Distichilis spicata*), makes up 13% of the remaining 39 species. Only five other species have been recorded with coverage greater than two to five percent.

3. Intermediate Marsh

Intermediate marshes extend farther inland than brackish marshes. In the Gulf of Mexico coastal zone they are distributed predominantly in the southwestern region of Louisiana and southeastern Texas.

A more diverse vegetation occurs in the intermediate marsh than the brackish or saline marshes. Based on the data given by Chabreck (1970), 54 species of plants or 35% more than in the brackish zone occur in the intermediate marshes. The dominant wiregrass makes up a third of the vegetation. Roseau (*Phragmites communis*), and bulltongue (*Sagittaria falcata*), comprise 6.6% and 6.5% of the vegetation, respectively.

4. Freshwater Marsh

Predominant freshwater marsh in the area is situated in the more central region of the Mississippi Delta near the distributary passes. Major species of vegetation in this marsh are: roseau cane, Eurasion water milfoil, alligator weed, duck weed, water hyacinth, dogtooth grass, bulltongue, and pondweed (Stone, 1972).

5. Seagrasses

Seagrasses consist of species of flowering plants that grow completely submerged (some are tidally emergent) in brackish to saline waters. They are limited to water where sunlight penetration permits photosynthesis, such as are found in the shallow waters of bays and around islands in areas of low turbidity.

Marine grass beds support one of the highest biomass densities in the marine environment. They not only provide a valuable food source for migratory waterfowl and shorebirds, but are also prime nursery grounds for shrimp, crabs and fishes of all types. While few animals feed on the grasses, many feed on organisms which attach to or live on them; viz., snails and mussels.

Seagrass communities are fragile ecosystems which advance and decline readily in response to minor changes in water quality, turbidity, or sediment loads and are vulnerable to storm damage. The U.S. Fish and Wildlife Service (personal communication) reported that the largest of these marine meadow communities in Louisiana is located immediately west of the Chandeleur Islands from Whitehouse Point south to the area of Polo Island. Species include *Syringodium filiforme*, *Thalassia testudium*, *Halodule beaudetti*, *Halophila engelmanni* and *Ruppia maritima*. Extensive areas of the Laguna Madre in Texas are carpeted by *Halodule beaudetti* while *Ruppia maritima* is common in sheltered coves. *Thalassia testudium* is limited to areas of the southern Laguna Madre; *Syringodium filigorme* is less common, but is increasing its range to the northward in the laguna. *Thalassia* and *Halodule* are common in estuaries of the central Texas coast, while *Ruppia* and *Halodule* are most common along the east Texas coast. Data are not available on other seagrass communities in this proposed sale area.

6. Estuaries and Embayments

Estuaries and bays are highly productive ecosystems. It is estimated that 97.5% of the total commercial fisheries catch of the Gulf States is made up of fresh and shellfish species that spend at least a portion of their life cycles in the estuaries (Gunter, 1967). They receive nutrients from upland areas via major river systems, especially during spring flooding. They also receive the nutrient wash-out from tidal flushing of the salt marsh, particularly the mid-winter when marsh grass of the previous season is decomposing. The dynamics of this system applies to the estuarine areas of both Texas and Louisiana.

7. Beaches and Barrier Islands

Much of the Texas and Louisiana coastline is protected from the full force of oceanic waves by barrier islands. The seaward margins of these islands, which are exposed to waves formed at sea, are called high energy beaches. Organisms living in such areas are adapted to survive the scouring force of wave action by burrowing into the sand. The sand bug (*Emerita talpoida*), the butterfly shell, the variable wedge shell (*Donax variabilis*), and others can bury themselves almost instantaneously. This ability enables them to live directly in the surf zone (Collard and D'Asaro, 1973).

Several groups of barrier islands front the Gulf coastal states affected by this proposed sale. Many offer environment distinct from the other island groups. Following is a list of the major barrier islands for the western and central Gulf of Mexico.

1. Brazos Island - Texas
2. Padre Island - Texas
3. Mustang Island - Texas
4. San Jose Island - Texas
5. Matagorda Island - Texas
6. Matagorda Peninsula - Texas
7. Galveston Island - Texas
8. Isles Dernieres - Louisiana
9. Timbalier Islands - Louisiana
10. Grande Isle - Louisiana
11. Grande Terre Islands - Louisiana
12. Chandeleur Islands - Louisiana

G. Human Utilization

1. Land Use

Coastal land use information for the states adjacent to the proposed lease sale area is variable in age, detail, and scale of treatment. In 1975 the Texas General Land Office published a detailed current coastal land use map under their Coastal Management Program. Louisiana is presently developing a similar coastal land use inventory, which is not yet complete. Visual No. 6 presents a highly generalized compilation from currently available land use maps.

a. Texas

Land use in the Texas coastal zone is highly variable both within and between regions and this requires its portrayal in general categories at gross scales.

In the northeasterly section of the coast, land use pressures are generally more intense because of the major population and industrial centers in that region as described in the Environmental Geological Atlas of the Texas Coastal Zone-Beaumont-Port Arthur Area (Fisher et al., 1973). A number of factors contribute to diversified and intensive land and water use, especially in the Houston, Galveston, Beaumont, Port Arthur and Orange areas. First, it is an area amply endowed with mineral resources which supports one of the major petroleum refining and petro-chemical centers of the world. Secondly, it is an area with fertile and productive agricultural lands and, finally, it contains major port facilities with extensive intracoastal waterways and ship channels that have led to a high-volume flow of imports and exports.

Many of the factors have led to diverse land and water use in the Beaumont-Port Arthur area and have also led to current and potential limitations and conflicts. Many of the resources of the area have varied uses, both present and potential. For example, water bodies are used simultaneously for transportation, commercial and sport fishing, recreation, oil and gas well locations, pipeline routes, as an area to fill for real estate development, and as a part of a waste disposal system. The importance of wetlands for aquatic organisms and as a source of organic input into aquatic ecosystems is now well understood, and has resulted in the enactment of legislation designed to prevent destruction of valuable wetland habitat.

The area is undergoing rapid and dramatic physical change involving active shoreline processes, hurricane flooding and damage, subsidence and surface faulting. These changes conflict with a variety of land and water uses.

In the lower reaches of the Texas coastal zone, many of the specific land uses are similar, but the acreage proportions differ from those to the north. Urban and industrial stress is less intense, and with the exception of the developed areas near Brownsville, Harlingen and Corpus Christi, land use is generally more extensive with large acreages devoted to agriculture, rangeland, and ranching.

Patterns of land use and intensity can be found in a report, Land Use Patterns in the Texas Coastal Zone (Flawn and Fisher, 1970). Highly generalized patterns of land use are shown on Visual No. 6 and a statistical summary of these acreages is shown in Table II-8.

A brief discussion of these principal land and water uses and their distribution within the 18 county coastal zone follows. A more comprehensive discussion can be found in the Final Environmental Impact Statement FES 74-63 written for OCS Sale No. 37.

Agriculture: Approximately 13,261 sq km (41%) of the total land in the Texas coastal zone are presently under cultivation. Concentration is on the original prairie grassland of the central and upper coastal zone. Agricultural use becomes less intensive in the south Texas coastal zone with the progressive decrease in rainfall.

Sixty percent of the total production of rice in Texas comes from the coastal zone. The main producing counties are Brazoria, Chambers, Harris, Jackson, Jefferson and Matagorda. Relatively high rainfall and extensive irrigation are main contributing factors.

The second most important agricultural crop producted in the coastal zone is grain sorphums, accounting for about 12% of the total state production. Principal yields are centered in the Corpus Christi area (Nueces and San Patricio counties) and in the southernmost part of the coastal zone (Willacy and Cameron counties).

Use of the coastal zone land in the production of cotton is significant only in the coastal bend (Calhoun, Nueces, and San Patricio counties) and in the lower Rio Grande Valley (Willacy County).

Minor quantities of corn, hay, oats and wheat are produced accounting for less than three per-

Table II-8. Statistical Summary of Land Use - Texas Coastal Counties

Use	Totals
Total area 1/	16128.0
Total land area 2/	13818.0 - 86.0
Total water area 2/	2310.0 - 14.0
Land Areas	
Agriculture 3/	5711.0 - 37.0
Range and ranch 3/	4425.0 - 32.0
Woodland and timber 3/	1609.0 - 11.6
Marsh and swamp 3/	762.7 - 5.5
Urban industrial and residential 3/	969.7 - 7.0
Recreational 3/	23.3 - 0.2
Subaerial spoil 3/	84.7 - 0.6
Made land 3/	33.8 - 0.2
Wildlife refuge 3/	213.4 - 1.5
Barren land 3/	579.4 - 4.2
Water Areas	
Bays 2/	2075.3 - 12.9
Artificial reservoirs 1/	64.7
Natural fresh water bodies 1/	170.0
Other Features	
Bay shoreline 4/	1419.3
Open ocean shoreline 4/	373.1
Total shoreline 4/	1792.4
Drainage channels 4/	3120.0
Transportation canals 4/	668.0
Hurricane flood areas 3/	3208.0 - 23.3

1/ Measured in square miles.
2/ Measured in both square miles (left number) and % of total area (right number).
3/ Measured in both square miles (left number) and % of total land area (right number).
4/ Measured in linear miles.

Source: Flawn and Fisher, 1970.

cent of the total state production. Concentration of crops is in the central coastal zone (Matagorda, Brazoria and Harris counties) and is co-extensive with the area of principal beef production.

Range and ranchland: Approximately 42% (11,461 km^2) of the total area of the coastal zone is devoted to range and ranch sites; marshlands used as range sites include an additional 1,968 km^2. Principal sites include the more arid region of south Texas, the low-lying coastal marshes, and the nonwooded barrier islands and levees of the central and upper coastal zone. The grazing of beef is the principal use of the range land and is most significant in Brazoria, Harris, Jackson, Matagorda and Victoria counties.

Woodland and timber: Woodlands occur throughout the coastal zone of Texas but are most extensive in Orange, Brazoria, Matagorda and Kenedy counties. Smaller areas of woodlands occur along streams, including low-swamp areas with water-tolerant vegetation, and on certain of the abandoned Pleistocene barrier island sands. Total woodland area in the coastal zone is approximately 4,144 km^2. Principal vegetation in the upper coastal zone woodlands includes pine and mixed hardwoods; in the central coastal zone, a variety of water-tolerant hardwoods; and in the southern coastal zone, oak.

Marshlands: Approximately 1,968 km^2 of the Texas coastal zone is marshlands or wetlands. These include dominantly low-lying areas, the landward sides of barrier islands, and low areas at the terminus of major river valleys and associated bayhead deltas. Salt, brackish, and fresh-water marshes are restricted to areas below four feet above mean sea level. Grasses of varying tolerance to fresh and salt water are the sole vegetation. Most of the marshlands are used for the grazing of beef cattle.

Urban industrial and residential: The principal urban and industrial concentration is in the upper part of the coastal zone. Highest concentrations are in Jefferson (Port Arthur area), Galveston (Galveston area), Harris (Houston area) Brazoria (Freeport area) and Nueces (Corpus Christi area) counties. Nearly 2,590 km^2 are included in this use category.

Recreation: The area designated as recreation is primarily the public beaches of the coastal zone. This amounts to a total area of about 60 km^2. Not included are a variety of public parks and other recreational areas, surface waters and the Padre Island National Seashore (Visual No. 1).

Designated wildlife refuge: (Source: Texas A & M University, 1972). Five major national wildlife refuges are designated in the Texas coastal zone including: Anahuac Refuge (4,023 ha) in Chambers County; Brazoria (3,857 ha) and San Bernard (6,038 ha) refuges in Brazoria County, Aransas Refuge (22,190 ha) in Calhoun, Aransas and Refugia counties; and Laguna Atascosa Refuge (18,272 ha) in Cameron County. There is one state-owned wildlife management area, the J. D. Murphree Wildlife Management Area (3,400 ha) in Jefferson County.

Barren lands: Barren lands comprise nearly 1,502 km^2 in the coastal zone. Principal distribution of these lands is in the semiarid area from Kleberg County south, and includes extensive wind-tidal flats landward of Padre Island as well as some of the active dune fields on the south Texas sand sheet.

Made land and spoil: Made land, or land built up to higher levels by grading, represents about 88 km^2 in the coastal zone. This occurs principally in metropolitan areas along the coast. Some of the spoil areas have reestablished vegetation; other areas are barren.

Water: The extensive bays of the coastal zone comprise the principal surface-water bodies covering approximately 5,439 km^2 and making up about 13% of the total surveyed area. Principal bays and estuaries include Sabine Lake; Trinity-Galveston Bay, including East and West Bays; Matagorda Bay, including East Matagorda Bay; Espiritu Santo Bay; Lavaca Bay, San Antonio Bay; Aransas Bay, Copano Bay; Corpus Christi Bay; Baffin Bay; and Laguna Madre.

Fresh water bodies existing either as natural water bodies or as artificial reservoirs comprise the other water areas of the coastal zone. The surface area of natural water bodies is about 4,403 km^2; artificial reservoirs cover about 150 km^2.

Hurricane flood zone: Approximately 8,309 km^2 of the lower part of the Texas coastal zone have been inundated by salt water from surges of hurricanes Carla and Beulah during the past decade. Particularly prone to flooding are the low coastal marshes and the lower reaches of the main river valleys.

Shoreline: Total shoreline in the Texas coastal zone is slightly over 3,041 km. Of this total, 2,283 km are bay shoreline and 600 km open-ocean or gulf shoreline. The shoreline is a dynamic zone subject to constant change in the form of erosion or accretion and is thus subject to change in total length.

Canals: An extensive canal system has been developed in the Texas coastal zone including transportation, irrigation, and drainage canals. Major transportation canals total 1,075 km within the surveyed part of the coastal zone. Approximately 5,020 km of irrigation and drainage canals have been cut, mostly associated with agricultural lands.

Specific to the immediate shoreline is a land use study (Texas A & M University, 1972), which divided the coast into beach segments for the purpose of describing shoreline use. An abstract of this detailed study was included in the Final Environmental Statement FES 74-63 written for OCS Sale No. 37, and also in the Final Environmental Statement for FES 76-46, OCS Sale No. 44.

b. Louisiana

Forty-five percent of the State of Louisiana consists of coastal and floodplain wetlands (Louisiana Planning Corporation, 1972, Vol. 1, pp. 235-236). Of the 12 million hectares of estuarine water and wetlands nationally, Louisiana has over 2.8 million hectares more than any other state. These wetlands are primarily located in the Mississippi River Valley. The coastal marsh zone occupies a broad band of land from the State's Texas to Mississippi borders along the Gulf of Mexico (Visual No. 3). In these wetlands, and in the remainder of the coastal zone, lie the majority of Louisiana's people and industry. The activities of the people, their work and play, are closely tied to the use of the resources of the coastal zone (Louisiana Adv. Comm. Coastal Mar. Res., 1973).

The wetlands contain 80% of the manufacturing and some of the most valuable mineral resources of the region and of the United States. Large quantities of petroleum, natural gas, sulphur and salt are extracted. Together, activities of coastal and marine-related businesses provide more than 50% of Louisiana's tax revenues. Eighty percent of the State's population is located within the wetlands.

Opportunities for development offered by the Louisiana coastal area include the presence of rich oil and gas resources, agricultural lands, wildlife resources which support trapping and recreational activities, valuable fishery resources, and the proximity of the Mississippi River which serves as an important transportation route. These opportunities have given rise to industrial, urban and agricultural development, which in turn have supported population increases.

Table II-9 indicates the land use in coastal Louisiana by acres. It can be seen that marshlands comprise 63% of the land area of the coastal parishes. These marshlands are essential habitat for numerous economically important species of fish and wildlife and are the site of wildlife refuges and game management areas.

The following discussion will cover the major components of the environment and their condition as they presently exist in the coastal zone. This discussion relies heavily on the work conducted at the Center for Wetland Resources at Louisiana State University (Gagliano, 1972) and the Atlas of Louisiana, Miscellaneous Publication 72-1 (Newton, 1972).

Barrier Islands, Reefs and Gulf Shore Areas

These areas represent the first line of defense against storms and marine processes, regulating inflow and outflow of Gulf waters, and are valuable as wildlife habitats and recreation areas. They are vulnerable to erosion and hurricane damage.

Barrier islands, reefs and gulf shore areas extend along the entire Louisiana coast except for that part of the Mississippi Delta lying seaward of a line extending southwest of Breton Island.

There are two towns lying in this zone, Cameron in Southwest Louisiana, and Grand Isle in the Southeast. This zone also supports numerous but isolated fishing and trapping camps.

Fresh, Intermediate, Brackish and Saline Marsh Areas

These areas are extremely important as habitat for fish and wildlife, are an important component of the estuarine zones, are important recreational areas, and serve as buffer zones against storm generated surges.

Marsh areas extend along the entire coastline of Louisiana. They lie behind the barrier islands, reefs and gulf shore areas, or front directly on the Gulf as along the outer parts of the Mississippi delta.

This area is used extensively for hunting, fishing and trapping, and supports many isolated base camps.

Table II-9. Land Use in Coastal Louisiana
(No. of Acres)

Parish	Total Area	Water Area	Marsh-land	Forest Land	Agri. Land	Urban Land	Trans-port	Aggre-gate Land Ar.	Unac-counted Acreage 1/	Area Percent
Cameron	1,087,360	194,101	739,474	-	269,492	180	2,332	1,011,478	-118,219	-10.9
Iberia	414,080	49,050	115,164	115,000	129,618	5,210	4,805	369,797	-4,767	-1.2
Jefferson	382,720	136,960	157,237	-	7,379	24,030	2,838	191,484	54,276	14.2
Lafourche	865,920	168,239	390,742	156,000	179,339	3,320	3,884	733,285	-35,604	-4.1
Orleans	232,320	112,460	59,930	-	1,055	37,995	30,941	129,921	-10,061	-4.3
Plaquemines	895,360	322,788	494,101	-	53,658	4,515	2,321	554,595	17,977	2.0
St. Bernard	517,120	220,915	275,499	-	11,838	3,065	609	291,011	5,194	1.0
St. Mary	453,760	87,147	172,308	143,000	107,276	5,440	3,549	431,573	-64,960	-14.3
Terrebonne	1,144,320	314,883	621,118	122,400	73,183	5,730	5,027	827,458	1,979	0.2
Vermilion	844,800	79,927	402,807	31,600	372,439	3,520	8,214	818,580	-53,707	-6.4
Totals	6,837,760	1,686,479	3,428,380	568,000	1,205,277	93,005	64,520	5,359,182		
% of land in study area by type			63%	10.6%	22%	1.7%	1.2%	100%		

*Note 1/: Total area less water area = land area. Land area less the aggregated areas of marshland, forest land, agricultural land, urban land and transportation land = unaccounted area. The result may be either positive or negative.

Source: State of Louisiana, 1967. A summary of preliminary findings concerning the Louisiana State Plan. La. Department of Public Works, Baton Rouge.

Estuarine Nursery Areas

These areas are the most biologically productive areas of the State, essential to the fisheries, and provide habitat for wildlife. This zone supports an extensive commercial as well as sport fisheries, the nature of which is more extensively discussed in other appropriate sections.

2. Ocean Dumping Areas and Military Use

a. Ocean Dumping

Ocean dumping under the 1972 Marine Protection Research and Sanctuaries Act is regulated by permits issued by the United States Environmental Protection Agency.

In the Federal Register of January 11, 1977 (Vol. 42, No. 7, pages 2462-2490), EPA published the "Final Revision of Regulations and Criteria" for "Ocean Dumping". All ocean dumping must have a permit, and in addition to detailing the permit process, EPA in this Federal Register also published two "Approved interim dumping sites" in the Gulf of Mexico at the following locations: 27°12′N to 27°28′N and 94°28′W to 94°44′W, and 28°00′N to 28°10′N and 89°15′W to 89°30′W. In addition, an "Approved Ocean Dumping Site" was designated for the purpose of incineration of primarily organochlorine wastes. This site is defined at that area within the following points: 27°06′12′′N, 93°24′15′′W; 26°32′24′′N, 93°15′30′′W; 26°19′00′′N, 93°56′00′′W; and 26°52′40′′N, 94°04′40′′W. These three areas are all well south of any of the tracts of this proposed sale. (It should be noted that these new dumping sites were promulgated too late to change Visual No. 5, on which the previous sites were plotted. For the correct locations of the currently approved sites, see Figure II-19.)

b. Dredging

The marine transport of huge tonnages of materials has led to the development of ports and navigable waterways that could accomodate deep draft vessels. The development and maintenance of these ports and waterways requires extensive dredging of large volumes of sediments each year. The principal responsibility for dredging operations is vested with the U.S. Army, Corps of Engineers. EPA, however, having responsibility for water quality, has designated a number of "Dredged Material Sites", the locations of which are contained in the above mentioned Federal Register. These are all inshore in the vicinity of the Intracoastal Waterway or dredged channels and harbors. None of the tracts of this proposed sale are near these sites, and there will be no mutual interference.

Dredging entails the excavation of bottom material. The types of dredging devices fall into two classifications - hydraulic and mechanical. Mechanical dredges pick up material by various types of buckets. Hydraulic (or suction) dredges utilize a centrifugal pump which moves a slurry of water and material through a pipeline either into the hold of hoppers or to a distant discharge point.

The mechanical dredges discharge either alongside the place of excavation, or into barges. This type of dredge is used extensively around breakwaters, docks and piers in maintenance dredging. It is mostly applied to excavating soft and cohesive subaqueous materials as silts and stiff muds.

The hydraulic dredges all have a suction line through which the excavated material is diluted with water and pumped to the disposal site either on shore, alongside the barge or into the hold of the dredge. The hopper dredge is an example of this type and is suitable for all but very hard materials. This type is generally used for maintenance and improvement of harbors, rivers and bays where near-by dumping grounds are not available. The cutter dredge is another example of the hydraulic type. This type is used in excavation and maintenance, and is used to dredge rock-like formations such as limestone without blasting and rock after blasting.

Each year dredging operations are carried out in major harbors and along the intercoastal waterways. The disposal of the dredged material varies from open ocean dumping sites, diked areas near shore and onshore dumping sites. Following is a brief summary of some of the major dredging operations that occur along the Gulf coast.

Texas

There are two types of dredging operations along the Texas coast, hopper dredging which occurs in open water and at the entrance to bays, and pipeline dreding which occurs close to shore and in the intercoastal waterway. There are seven entrances to channels that are dredged, Brazos (240,000 cubic yards/year), Port Mansfield (130,000 cubic yards/year), Corpus Christi, Matagorda, Freeport, Galveston and Sabine-Neches. There are no records for the amount of material dredged for the latter five areas. The estimated total amount of maintenance dredging that occurs in these areas is 7.6 million cubic yards/year with new dredging accounting for 1.4 million cubic yards. All of the dredged material from these operations are disposed by ocean dumping.

The pipeline dredging operations occur along the intercoastal waterways and close to shore from Brownsville to the Texas-Louisiana border.

Louisiana

Thirty-eight percent of all U.S. dredging operations in the U.S. are handled by the New Orleans Corps of Engineers district office. Ninety percent of these operations are contracted and done by cutter head dredges. The Corps owns a hopper dredge which works mostly in Southwest Pass, Mississippi River-Gulf Outlet gulf approach channel, and the gulf approach channel to the Calcasieu River. All of the operations dispose of the dredged material in open water.

There are five major dredging operations, these are located in the delta area. A Southwest Pass operation from the head-of-pass to the Gulf of Mexico, about 32 km (20 miles) dredges a navigation channel on a yearly basis. There is approximately 7.2 million cubic yards/year of material dredged from this area and disposed of along the channel in the east and west bay areas. This operation is handled by two cutter head dredges.

The Atchafalaya Bar Channel is also dredged annually by two cutter head dredges. Approximately 10 million cubic yards/year of material are dredged and disposed of in open waters.

There is one hopper dredge in operation which is owned by the Corps of Engineers. This dredge operates in various locales during different times of the year. One area in which it operates is a Gulf entrance channel in Breton Sound nine miles out into the Gulf. This is a major deep draft shipping channel from which 6.6 million cubic yards/year of material is dredged. This dredged material is disposed of by ocean dumping. This dredge also operates around the mouth of the Calcasieu River where it dredges approximately 12 million cubic yards/year and in the jetty channel beyond 32 km (20 miles) of Southwest Pass where it dredges approximately 15 million cubic yards/year. The dredged material from both these sites are disposed of in the open water.

c. Military Uses of the Continental Shelf

The Gulf of Mexico is used rather extensively by the U.S. Navy and Air Force for conducting military training, testing and research activities. These current activities consist of missile testing, ordnance testing, drone recovery operations, pilot training and electronic counter measure (ECM) activities by the Air Force. Mine research activities are conducted by the Department of Navy. Most of this activity takes place in areas designated for these purposes (Fig. II-19). However, live ordnance testing by the Air Force occasionally involves emergency release of ordnances outside designated bombing areas. These ordnances range from small munitions to 544 kilogram bombs. The occurrence of unexploded munitions on the ocean floor in the proposed sale area is a possibility in certain locations. The following tracts of this proposed sale are located within these military operating areas: 1–17 and 21 in area W-228A; and 34, 35, 54, 55, 57, and 58 in area W-602.

The U.S. Navy has conducted no munitions dumping in water less than 914 m in depth since 1945. Additional information received from the Office of the Oceanographer of the Navy indicates other sites are located off the Atlantic and Pacific coasts and no sites are utilized in the Gulf of Mexico.

The U.S. Air Force owned and leased approximately 20,235 hectares on Matagorda Island which were used for a variety of military purposes. All of this property has been determined to be in excess of the requirements of the Department of Defense (DOD). Disposal of this property has been cleared with Congressional Armed Services Committees and a Report of Excess has been issued by the General Services Administration (GSA). All military uses of this property ceased as of June 30, 1975. Action is currently underway to clear the property of unexploded ordnance residue (U.S. Department of Defense, 1975).

The excess portion of Matagorda Island features prime recreational and wildlife resources. Currently proposed use plans focusing on the island's major resources are being assessed by GSA in considering reuse and disposal of this former military property.

3. Recreation and Allied Resources

The northern Gulf of Mexico coastal zone is one of the major recreational areas of the U.S. particularly in connection with salt-water fishing and beach-oriented activities.

There is considerable diversity in natural landscapes from the barrier islands of Texas through the marshes of Louisiana. Large numbers of visitors are attracted from outside the region by these natural conditions, as well as the subtropic climate.

In Louisiana, inaccessibility of the coastal marshlands to automobile travelers has limited the development of recreational facilities to a few areas. However, the vast marshlands provide abundant game and fish which attract sport fishermen and hunters.

Public parks and preserves provide opportunities for hunting, fishing, camping, wildlife viewing, and photography. Commercial recreational facilities are also very important as well, and include ornamental gardens, marinas and a variety of resorts and services.

The long and colorful history of the Gulf South has provided a rich legacy in architectural forms, historic sites and historic districts. The prehistoric record of archaeological remains in this area is also large and continually expanding through discovery and research.

A. SPORT FISHING

Limited access to fishing areas, especially in Louisiana, has precluded full utilization of the sport fishery resources but mandays effort and pounds of catch are impressive. A salt-water angling survey conducted by the National Marine Fisheries Service (NMFS) in 1970 provides the most recent comprehensive sport fishing statistics for the Gulf of Mexico (Deuel, 1973). Visual No. 5 displays coastal zone and offshore fisheries for the western and central Gulf areas. Also of interest in the connection will be Visual No. 4 showing undersea features.

Table II-10 illustrates the number of salt-water anglers and their catch in the western Gulf of Mexico (Mississippi River Delta to the Mexican border) and its relationship to the total U.S. catch for 1970. Table II-11 illustrates the salt-water fishermen and their catch for the western Gulf of Mexico for 1970.

More detailed information on sport fishing activity, catch and value is not uniformly available for the Gulf of Mexico, although research is underway which should improve this situation. The National Marine Fisheries Service has established two sport fishing laboratories in the Gulf area and has undertaken with their port sampling of commercial products the gathering of sport fishing data.

Party boat fishing is characterized by the use of a large boat in the range of 17 to 20 m carrying a large number of people. Bottom fishing consumes the majority of fishing time, although less often drift fishing and trolling methods are used. Party boats usually charge a set fee per person (per "head") and may require a certain minimum number of passengers aboard before they make a trip.

Charter boat fishing is characterized by the use of a smaller boat, about 10 to 14 m in length, carrying up to 6 or 8 persons. Trolling is the primary method used.

It is estimated that approximately 80% of all fishing activity occurs within 20 km of shore (U.S. Dept. of Commerce, NOAA 1973). A further rationale for the location of this 20 km line was the consideration of the maximum distance a party or charter boat can travel and return to shore in one day and allow adequate time for fishing in place of anchor.

Louisiana: Sport fishing in Louisiana is a very popular form of recreation. Coastal marshland with few roads reaching the shoreline has limited fishing access and precluded full utilization of the saltwater fishery resources. Nevertheless, a high percentage of Louisiana residents own or have access to boats.

A statewide recreation participation survey of Louisiana residents in 1973 indicated 30% of the populations participated in saltwater fishing on an average of 2.2 times during the year (La. SCORP, 1974). Based on 1970 population figures almost 2.5 million saltwater fishing occasions were enjoyed by Louisiana fishermen in 1973.

A 1968 U.S. Fish and Wildlife Service survey determined the average catch for a man-days effort of fishing in the Louisiana coastal area amounted to 7.2 lbs. or more than 3 kg. Some of the most popular saltwater sport fish are seatrout, red drum, croaker, flounder, snappers and mackerel.

Surf-fishing is popular along the barrier islands of coastal Louisiana, however, most of these islands are accessible only by boat. Sport fishing

Table II-10. Estimated Number of Salt-Water Anglers & Their Catches in the West Gulf Coast of Mexico & Relationship to the Total U.S. Catch for 1970.

	No. of Anglers (000)	% of U.S. Total	No. of Fish Caught (000)	% of U.S. Total	Weight of Fish Caught (000 lbs.)	Weight of Fish Caught (000 kg)	% of U.S. Total
West Gulf of Mexico (Miss. River to Texas)	872	9	97,708	12	151,608	6,822	10
Total U.S.	9,392		817,317		1,576,823	70,957	

Source: Deuel, 1973.

Table II-11. Salt-Water Fishermen and Their Catches 1/
by Principal Area and Method of Fishing - 1970

Region	Principal Area of Fishing: Ocean	Principal Area of Fishing: Sounds, rivers, and bays	Principal Methods of Fishing: Private or rented boats	Principal Methods of Fishing: Party or chartered boats	Principal Methods of Fishing: Bridge, pier, or jetty	Principal Methods of Fishing: Beach or bank
	Thousands					
West Gulf of Mexico:						
Number of fishermen. . .	341	477	284	101	288	198
Number of fish caught. .	47,173	50,535	56,684	4,425	23,236	13,363
Total weight(lbs.) . . .	64,800	86,808	85,505	8,579	33,024	24,200
Total weight (kg.) . . .	2,916	3,906	3.848	387	1,486	1,089

1/ The number of fish caught and the weight of fish caught in the two principal areas of fishing are equal to the total catch for a region, and the number and weight caught by the four methods of fishing are equal to the total catch for a region. However, the number of anglers is not additive as some anglers fished in both areas and by more than one method for certain species groups in a particular region.

Source: Deuel, 1973.

Table II-12. Total Participation in Saltwater Activities Occurring in Rural Areas Within Texas Gulf Coast Regions (Activity Days)

	Region						
Activity	27	25	28	24	33	34	Total
Salt.Boating	101,000	11,000	655,800	700	513,300	157,900	1,439,200
Salt.Fishing	185,600	336,000	2,873,000	28,000	2,890,800	910,600	7,224,000
Salt.Skiing	*	2,000	98,100	*	34,000	15,000	149,100
Surfing	*	3,000	205,900	*	98,200	74,000	381,100
Total	286,600	352,000	3,832,800	35,000	3,536,300	1,157,500	9,193,900

*Asterisk indicates that projected annual activity days were less than 50.

Source: Texas Outdoor Recreation Plan, "Outdoor Recreation on the Texas Gulf Coast", Volume V, pages 298-314.

around offshore oil and gas rigs is also popular. Therefore, the large number of man-days spent in sport fishing indicates a corresponding high level of boating activity. In September, 1970, there were 101,084 registered boats in twelve parishes of Louisiana (Jones and Rice, 1972). This figure includes commercial vessels, but the greatest portion are private recreational boats.

Texas: The Texas coastal zone, with its immense expanse of shallow bays and beaches accessible to the average man, furnishes an excellent region for the sport fisherman to pursue his avocation. Based upon recent data presented in "Outdoor Recreation on the Texas Gulf Coast", volume one of the Texas Outdoor Recreation Plan (TORP), the Comprehensive Planning Branch of the Texas Parks and Wildlife Department ranks fishing as the number one recreational activity in the coastal region of Texas in terms of activity days of participation.

Updated TORP estimates indicate the most popular coastal recreational activity is fishing with 12,814,900 activity days recorded, followed by swimming (9,460,100), picnicking (4,688,900), boating (3,402,800), and camping (3,267,400). Table II-12 shows saltwater based activities occurring in the same region but excluding those occurring within urban limits. Fishing again stands out with nearly 7.2 million activity days.

A study of onshore-offshore recreational fisheries conducted through the National Marine Fisheries Service (1976) for an area extending seaward from the Gulf shoreline between Port Isabel and Port Aransas identified kingfishes, bluefish, seatrout, croaker, finfish and catfish as the major species caught by pier, boat and jetty fishermen. Red snapper, king mackerel and little tunny were principal species harvested by headboat and inboard motorboat fishermen whereas spanish mackerel and crevalle jack joined the king mackerel as the fishes most often caught from outboard motorboats. Nearly 350,000 anglers participated in saltwater fishing in the study area during the six month survey period (Table II-13). Another section of this NMFS study (Table II-14) gives an indication of the relative abundance and catchability of billfishes sought offshore by fisherman embarking in the vicinity of Port Aransas. The results showed sailfish were most abundant in 1975, whereas blue and white marlin were most abundant in 1974.

Personnel from the Texas Parks and Wildlife Department (1976) recently completed a creel survey of anglers in the Galveston, San Antonio and Aransas bays and upper Laguna Madre areas fishing from boats, banks and piers. This study resulted in an estimate of the species and total catch by recreational fishermen. During the one year survey period (Sept. 1974-Aug. 1975) sport anglers in the four bay systems harvested over five million fish weighing 218,952 kg. This catch resulted from an estimated 1,633,600 fishing trips with boat fishermen accounting for more than 80% of the catch. Spotted seatrout showed up in almost 50% of sport angler's creels with red and black drum, southern flounder, sheepshead, and gafftopsail catfish representing other major harvest species in the Texas coastal embayments surveyed.

Data from the 1970 National Angling Survey estimated a total of 872,000 sport fishermen were involved in the saltwater sport fishing effort in the western Gulf, Mississippi River Delta to Mexican border. These fishermen caught 69 million kg which would give an average yearly catch of 79 kg per fisherman. The number of fish caught was estimated to be 97,708,000, yielding an average weight per fish of 0.7 kg.

Tables II-15 and II-16, from the 1970 Saltwater Angling Survey (Deuel, 1973) provide detail of the methods of fishing, species of fish caught, their weight and numbers caught in the western Gulf of Mexico.

Big game fishing: Big game fish (also referred to as billfish) are sought in deep water and at considerable distance from shore.

Based on three years of data collection, Luis R. Rivas (1972) of the National Marine Fisheries Service made the following comments about the billfish sport fishery of the northern Gulf of Mexico.

During the season (April through October) the fishing effort expended on billfishing amounts to an annual average of 11,756 hours of trolling equivalent to 1,680 boat days. It takes, on the average, 18 fishing days to boat a blue marlin, seven to boat a white, and six to boat a sailfish. Therefore, in 18 days of trolling, it is possible to boat one blue, two whites and three sails for a total of six billfish, or an average of one fish per three days of trolling. On the average, 657 billfishes weighing a total of 25,303 kg are caught every year. An average of 103 blue marlin weighing a total of 12,988 kg are caught by an-

Table II-13. Estimates of mean daily efforts and total effort by section, fishing platform, and time of week in the study area, 28 April-9 November, 1975.

Section and Fishing Platform	Weekday Mean Daily Effort	Weekday Total Effort	Weekend-day Mean Daily Effort	Weekend-day Total Effort	Total Effort Weekday and Weekend-day	Percent of Total
	-----------------Man-days of fishing--------------------					
Mustang Island						
Outboard	45.46	6,091	102.59	6,361	12,452	3.61
Inboard	78.50	10,519	243.16	15,076	25,595	7.43
Headboat	184.86	24,771	216.81	13,442	34,213	11.09
Jetty	96.37	12,913	213.11	13,213	26,126	7.58
Pier	178.43 1/	47,819 2/	289.23 1/	35,864 2/	83,683	24.29
Beach	185.67	24,880	387.26	24,010	48,890	14.19
Upper Padre						
Beach	55.69	7,462	332.75	20,630	28,092	8.16
Mid Padre						
Beach	12.76	1,710	72.36	4,486	6,196	1.80
Lower Padre						
Outboard	19.81	2,655	52.52	3,256	5,911	1.72
Inboard	35.99	4,823	101.67	6,303	11,126	3.23
Headboat	26.72	3,580	20.44	1,267	4,847	1.41
Jetty	117.08	15,689	216.31	13,411	29,100	8.45
Pier	16.11	2,159	16.21	999	3,158	0.92
Beach	81.02	10,857	164.66	10,209	21,066	6.12
TOTAL		175,928		168,527		
GRAND TOTAL					344,455	100.00

1/ Per pier
2/ Both piers

Source: U.S. Dept. of Commerce, 1976. NOAA Final Report - Environmental Studies of the South Texas Outer Continental Shelf, 1975. Volume I, p. 116.

Table II-14. Relative Abundance of billfishes off Port Aransas.

	No. of hours trolled	No. of fish raised	No. of fish raised per hr. of trolling	Hours trolled to raise 1 fish
1972	1,482.4			
Blue Marlin		73	.049	20.4
White Marlin		30	.020	50.0
Sailfish		133	.090	11.1
Unidentified Billfish		1	.001	1,000.0
All Billfish		237	.160	6.3
1973	810.9			
Blue Marlin		35	.043	23.3
White Marlin		8	.010	100.0
Sailfish		47	.058	17.2
Unidentified Billfish		2	.002	500.0
All Billfish		92	.113	8.8
1974	1,298.3			
Blue Marlin		107	.082	12.2
White Marlin		34	.026	38.5
Sailfish		182	.140	7.1
Unidentified Billfish		11	.008	125.0
All Billfish		334	.257	3.9
1975	2,389.7			
Blue Marlin		90	.038	26.3
White Marlin		27	.011	90.9
Sailfish		620	.259	3.9
Unidentified Billfish		1	.001	2,500.0
All Billfish		738	.309	3.2

Source: U.S. Dept. of Commerce, 1976. NOAA Final Report - Environmental Studies of the South Texas Outer Continental Shelf, 1975. Volume I, p. 141.

Table II-15. Number of Fish Caught by Saltwater Anglers in 1970 in the Western Gulf of Mexico by Species and by Principal Area and Method of Fishing. (Thousands)

Species	Principal Area of Fishing: Ocean	Principal Area of Fishing: Sounds Rivers & Bays	Principal Method of Fishing: Private or Rented Boats	Principal Method of Fishing: Party or Charter Boats	Principal Method of Fishing: Bridge Piers or Jetty	Principal Method of Fishing: Beach or Bank
Catfish	3,083	12,307	4,512	725	7,661	2,492
Croakers	5,476	8,417	3,384	892	6,237	3,380
Drum, Black	724	4,363	4,435	16	457	179
Drum, Red	2,366	3,545	4,131	47	418	1,315
Flounders, Summer	984	1,192	1,714	124	185	153
Grunts	11,805	20	11,555	-	270	-
Kingfish	2,712	531	541	163	2,279	260
Porgies	470	1,498	1,107	163	225	473
Sea Trout, Sand	5,282	2,907	5,645	450	1,515	579
Sea Trout, Spotted	11,185	13,113	17,615	985	2,599	3,099
Snappers	1,047	168	537	390	288	-

Source: Deuel. 1973.

TABLE II-16.

SALTWATER SPORTFISHING EFFORT IN THE WESTERN GULF OF MEXICO*
BY SPECIES GROUP, NUMBER OF FISH CAUGHT, NUMBER OF ANGLERS,
AND ESTIMATED WEIGHT OF CATCH.

Species Group	Number of Fish Caught (000)	Number of Anglers (000)	Estimated Weights (000 lbs)
Basses	12	4	24
Bluefish	477	24	1,308
Bonitos	12	6	37
Catfishes	15,390	279	17,800
Cobia	85	3	43
Croakers	13,893	403	14,743
Drum, Black	5,087	185	13,004
Drum, Red	5,911	302	25,520
Eel, American	17	17	19
Flounders, Summer	2,176	211	2,985
Groupers	438	40	922
Grunts	11,825	32	4,316
Jacks	145	40	1,223
Kingfishes	3,243	90	3,107
Mackerels, King	259	39	2,978
Mackerels, Spanish	479	31	608
Mullets	257	16	95
Perches	688	58	584
Pompanos	135	45	179
Porgies	1,968	164	5,675
Puffers	25	12	8
Sea Robins	4	4	1
Sea Trout, Sand	8,189	200	9,345
Sea Trout, Spotted	24,298	406	40,487
Sharks	68	12	1,167
Sharks, Dogfish	58	25	54
Skates and Rays	271	29	1,603
Snappers	1,215	49	2,554
Snappers, Red	119	12	278
Spadefish, Atlantic	190	30	283
Miscellaneous	774	45	658
Total	97,708	**	151,608

* The Western Gulf includes the area between the mouth of the Mississippi River and the Mexican border.

** The number of anglers is not additive because of duplication of anglers among species groups.

Source: Deuel, 1973.

glers every year. On the average, 252 white marlin weighing a total of 6,205 kg and 302 sailfish weighing a total of 6,027 kg are caught every year.

In the northern Gulf, the catch-per-unit-of-effort by the sport fishery, for all three species of billfishes combined, was 0.063 fish per hour of trolling in 1971, 0.041 in 1972, and 0.036 in 1973.

Trolling for billfishes is conducted above the continental shelf from about 55 m outward and also above the continental slope at depths of up to 914 m. The most important billfishing ports are Port Isabel, Port Aransas, Rockport and Port O'Connor in Texas.

The billfish sport fishery was practically nonexistent in the Gulf off the Louisiana Coast until about 20 years ago. Pioneered by the New Orleans Big Game Fishing Club, it has grown tremendously since its inception and it still continues to grow. Port Eads, Empire and Grande Isle are important billfishing ports in Louisiana.

Artificial reefs: In recent years, the establishment of artificial reefs has become popular in the Gulf of Mexico. These artificial reefs made of old car bodies, tires, concrete pipes, ships, rubble and numerous other materials provide additional surface area of hard substrate on which numerous types of algae and invertebrate species may grow. These organisms are available as food for foraging species which in turn, attract predatory fishes. In addition to the expanded food chain and tropic food level potentials, the artificial reefs serve as refuge, protection and orientation sites. These new sites, by attracting and concentrating fish species, improve fishing success. However, the population size of fish species are not necessarily increased.

The Texas Coastal and Marine Council has acquired 12 Liberty Ships to use as offshore artificial reefs. Four locations have been established, each of which will be a site for establishing a reef by sinking three stripped-down Liberty Ships. The reefs are from 20 to 55 km from shore which make them accessible to sport fishermen and divers. However, they are in water at least 24 m deep in order to allow clearance for navigation. Three ships have been placed in Block 1070, South Padre Island near Port Mansfield and one ship has been sunk in Block 802, Mustang Island. Additional ships are ready for sinking and others are in various stages of preparation for artificial reef material.

Structures placed in the marine environment by the petroleum industry often provide underwater surfaces suitable for establishing artificial reefs. Marine organisms and ultimately sport fish are known to congregate near such areas. The more than 700 multiwell oil and gas platforms in the OCS, most of which lie seaward of Louisiana's coastline, are becoming increasingly popular as sport fishing destinations. No reliable figures exist on the number of persons who venture into the OCS for fishing near platforms however, it is generally recognized that the numbers are significant and increasing.

b. Recreational boating

A 1973 National Marine Fisheries Service study provides a general overview of recreational boating in the U.S. and its subdivisions, including the states bordering the Gulf of Mexico. As of October 1973 there were 8,008,000 privately owned recreational fishing boats in the U.S. (Ridley, 1975) and some 1,010,000 of these boats were used in saltwater recreational fishing activities. It was further estimated that commercial recreation fishing boats in the U.S. numbered 2,496. Table II-17 provides more detailed data for the Gulf of Mexico Region. In this region 349,000 private recreation boats were used in saltwater. Most of these boats were under 26 feet (8 m) in length. There were also 473 commercial recreational fishing boats, predominantly in the 40′ - 65′ (12-20 m) length class.

In 1970 there were 101,084 boats of all types over 12 feet (3.7 m) in length registered in coastal parishes of Louisiana.

Boating in Louisiana's coastal area is most often related to recreational fishing. Water skiing and sailing are growing in popularity especially in estuarine lakes like Lake Pontchartrain, Lake Charles and Vermilion Bay near south Louisiana's major urban centers.

Boating in Mississippi coastal waters is also very popular with major concentrations of saltwater recreational boats at Pass Christian, Gulfport and Biloxi harbors.

In Texas the use of boats for fishing and for a variety of other recreational activities is increasing rapidly. Data compiled by the Texas Parks and Wildlife Department between 1970 and 1975 show that the total boat registration in the 17 Texas coastal counties increased over 100% (from 73,393 to 143,471). The top ten coastal counties

Table II-17. Recreational Boating Activity in States Bordering the Gulf of Mexico
November, 1972 - October, 1973

	Less than 16'	16-26'	Greater than 26'	Total
Estimated No. of Private Recreational Boats	988,000	389,000	31,000	1,408,000
No. of Private Recreational Boats that Fished in Saltwater	190,000	141,000	18,000	349,000
	Less than 40'	**40-65'**	**Greater than 65'**	**All Classes**
Estimated No. of Commercial Recreational Fishing Boats	85	310	42	473

Major Species of Fish Sought By:	Open Ocean	Rivers, Sound, and Bays
Private Recreational Boaters	Groupers, Red Snappers, Trouts, Snook	Spotted Sea Trout, Red Drum, Snappers
Fishermen on Commercial Recreation Boats	Red Snappers, Snappers, Groupers, King Mackerel, Kingfishes	Red, Snapper, Spotted Sea Trout, Sand Sea Trout

Source: Ridgely, 1975.

accounted for approximately 30% of all boats registered in Texas during this period.

Population and public access to water seem to be the major factors bearing on boat numbers. Harris County has the largest population and by far the largest number of boats registered in the coastal zone. In general, the counties with high boat registration have access to a large amount of bay and ocean frontage. However, Harris, Orange and San Patricio Counties have no open ocean frontage and relatively little bay frontage, but they do have water access to the ocean and a great deal of fresh water located in or near their boundaries.

The importance of these boats for outdoor recreation is indicated by over 96% of those registered in this area in 1975 being classified as "pleasure use" craft. Table II-18 illustrates the top ten coastal counties in boat registrations for Texas.

c. Hunting

Hunting is one of the higher ranking outdoor recreational activities in the Western Gulf area. Important mammals include deer, squirrels, rabbits and occasionally raccoons. Upland birds include quail, dove and turkey. A variety of waterfowl are taken throughout the coastal marshes whereas gamebirds such as gallinule, snipe, woodcock and rails are popular in more localized regions.

d. Outdoor recreation areas

Included under this heading are Federal and State wildlife refuges, game management areas, state and national parks, beaches used for recreation, ornamental gardens, and historical and archaeological sites. These are portrayed on Visual No. 1.

National Parks: The National Park Service administers one National Seashore and the Chalmette National Historical Park within the coastal areas of Texas and Louisiana.

Padre Island National Seashore occupies 54,420 ha of Padre Island extending 129 km along the south Texas shore from Corpus Christi to near the mouth of the Rio Grande. Besides being one of the last natural seashores in the nation, Padre Island is a wintering area for migratory waterfowl. The island offers numerous recreational activities including swimming, camping, surfing, surf fishing, hiking, and birdwatching. In 1975 Padre Island National Seashore received 893,000 visits.

Chalmette National Historical Park was the scene of the Battle of New Orleans in the War of 1812. This 55 ha park includes the inactive Chalmette National Cemetery and received 230,000 visits in 1975.

The eastern most islands of the Gulf Islands National Seashore (Ship, Horn and Petit Bois) are located off the coast of Mississippi near the Mississippi River Delta. Horn and Petit Bois Islands are being considered for inclusion into the National Wilderness System.

National Natural Landmarks: The National Park Service administers the National Landmarks program. The objective of this program is to assist in the preservation of natural areas which will illustrate the diversity of the country's natural history. Registration of a site as a Natural Landmark does not change its ownership. However, the owner of the site is required to preserve the natural character of the registered site in order to retain its registration as a Natural Landmark.

There are as yet no registered national natural landmarks in the coastal zones of Louisiana or Texas. A major research effort has been sponsored by the National Park Service to identify and evaluate potential natural landmarks in the Gulf Coastal Plain Physiographic Region of the U.S.

National Wildlife Refuges: The U.S. Fish and Wildlife Service of the U.S. Department of the Interior has the responsibility for ensuring the conservation of the country's wild birds, mammals and sport fish. The primary purposes of wildlife refuges are to provide sanctuaries for wildlife and fish by preserving breeding grounds and habitat which may be becoming scarce in other areas due to encroachment on natural habitats by agricultural, industrial and urban development, and to provide opportunities for the scientific study of various species of wildlife and for the management and preservation of their populations. These refuges also provide important opportunities for outdoor recreation, primarily nature study and natural scenery appreciation.

The Louisiana coastal zone contains four National Wildlife Refuges. The Delta-Breton National Wildlife Refuge consists of Breton and Chandeleur Islands which were incorporated into the system in 1904 and contain 1,824 ha. Many waterfowl and shore birds frequent the islands, and sea turtles nest on their shores. They may be reached only by water and there are no recreational facilities although surf fishing from the

Table II-18. Top Ten Texas Coastal Counties in Boat Registration 1970-1975

1970

Rank	County	No. of Boats Registered	County	No. of Boats Registered
1	Harris	39,819	Harris	78,418
2	Jefferson	7,904	Jefferson	15,865
3	Galveston	4,935	Galveston	8,488
4	Nueces	4,908	Nueces	7,881
5	Brazoria	3,699	Brazoria	7,861
6	Orange	3,604	Orange	7,796
7	Cameron	1,538	Victoria	2,764
8	San Patricio	1,524	San Patricio	2,729
9	Calhoun	1,191	Cameron	2,720
10	Matagorda	1,075	Matagorda	1,828
	TOTAL	70,197	TOTAL	136,350

Source: Boat Registration Division, Revenue Branch, Texas Parks and Wildlife Department, letter of September 24, 1976.

Table II-19. State Wildlife Management Areas and Preserves

Name of Area	County	Hectares
Louisiana		
Pearl River	St. Tammany (Parish)	10,812
St. Tammany	St. Tammany	526
Biloxi	St. Bernard	16,019
Bohemia	Plaquemines	6,475
Pass-A-Loutre	Plaquemines	26,710
Wisner	Lafourche	8,750
Salvador	St. Charles	11,129
Pointe au Chien	Lafourche	11,430
Rockefeller	Cameron	33,185
Louisiana State	Vermilion	6,070
Marsh Island	Iberia	31,971
Manchac	St. John the Baptist	2,129
Texas		
J. D. Murphree	Jefferson	3,401
Sheldon	Harris	1,013
Las Palomas		283
Longoria Unit	Cameron	
Voshell Unit	Cameron	
Fredericks Unit	Willacy	

Source: Louisiana State Parks and Recreation Commission, 1974
Texas Parks and Wildlife Dept., 1974

islands is very popular. Most of the island portions of this refuge have been incorporated into the National Wilderness system. The Delta section of the refuge is on the east bank of the Mississippi River, 11 km below Venice and is accessible only by boat. The refuge contains 19,749 ha. Thousands of blue and snow geese and many species of ducks arrive each fall from the northern breeding grounds to winter on the Delta marshes. Deer and fur-bearing animals are found in abundance. Alligators are seen frequently. Sport fishing is permitted.

Lacassine National Wildlife Refuge is located in southwest Louisiana. At this 12,856 ha waterfowl wintering area one can see the largest concentration of white-fronted geese in the Mississippi Flyway and one of the larger populations of fulvous tree ducks in the U.S. Part of the refuge is open to waterfowl hunting. A main attraction is a 6.475 ha fresh water pool where sport fishing is encouraged. Shell Keys National Wildlife Refuge is under the administration of Lacassine Refuge. Established in August of 1907, Shell Keys Refuge is a 20 ha colonial bird nesting island offshore in the Gulf of Mexico.

Also in southwest Louisiana is the Sabine National Wildlife Refuge. Established in December 1937, and located in Cameron Parish the refuge contains 57,809 ha. It includes three large artificial freshwater impoundments, and is bounded on the west and east by two large brackish lakes, Sabine and Calcasieu. Sabine provides a winter home for thousands of geese and ducks. Flocks of blue and snow geese may be seen feeding in the marshes adjacent to the highway. Sport fishing and waterfowl hunting are permitted. The wildlife trail in Pool 1B affords excellent opportunities for visitors in all seasons.

There are five national wildlife refuges on the Texas Gulf coast. The eastern most refuge, Anahuac, occupies 4,023 ha on East Bay of Galveston Bay. The primary species for this refuge are: Lesser Canada, snow and blue geese, mottled ducks, masked ducks, canvasbacks and yellow rails. Rare and endangered species are alligators, bald eagles, peregrine falcons and the red wolf.

Brazoria National Wildlife Refuge contains 3,857 ha of coastal marsh and prairies in Brazoria County. Three-fourths of the refuge is less than 1.2 m in elevation, and spoil bank knolls and windbreak plantings are the only break in the marsh vegetation. The primary species of this refuge are: geese, ducks and muskrats, and endangered species include alligators and red wolves. The refuge offers public hunting and fishing in limited areas, sightseeing, birdwatching and nature photography. The refuge office, which also administers the San Bernard National Wildlife Refuge, is located in Angleton, Texas.

San Bernard National Wildlife Refuge, which was established in November 1968, is Texas' newest wildlife refuge containing 6,038 ha in Brazoria and Matagorda counties. The primary species for this refuge are: geese, ducks, wading birds, shorebirds and the endangered red wolf.

The Aransas National Wildlife Refuge occupies 22,190 ha in Calhoun, Aransas and Refugio counties and is the largest on the Texas coast. This refuge is the wintering ground for the rare and endangered whooping crane. Other primary species include: sandhill cranes, roseate spoonbills, egrets, herons, peregrine falcons, geese, ducks, turkeys, shorebirds, deer, peccaries, caracaras, white-tailed hawks, Texas red wolves and alligators.

Texas' second largest wildlife refuge, Laguna Atacosa National Wildlife Refuge, occupies 18,272 ha in Cameron County. Located 40 km northeast of San Benito, this refuge was established in March 1946 to serve as a wintering and feeding area. Principal species include: geese, ducks, herons, ibises, shorebirds, gulls, terns, doves, cranes, white-tailed hawks and whitetailed kites. The refuge offers a variety of habitat including coastal prairies, salt flats and low wooded ridges. Subtropical forms, such as the ocelot and the aguarundi, occur along with species from the northern latitudes. Tour roads, hiking trails, and blinds are provided for visitors to use in sightseeing, nature study and photography. Camping is permitted in designated areas, and saltwater fishing and boating are allowed in the Intracoastal Canal. A major portion of the Laguna Atascosa National Wildlife Refuge has been recommended for National Landmark recognition.

State wildlife refuges and management areas: All Gulf states maintain wildlife management areas within their coastal areas. Approximate size and geographic location of these wildlife lands are shown in Visual No. 1. Although management goals may differ somewhat between the states these areas serve primarily to maintain habitat and breeding space for wildlife and to provide wildlife-oriented recreation under closely controlled conditions.

The Texas Parks and Wildlife Department administers three state-owned wildlife management areas. They range from 203 ha to 3,401 ha in size. The smallest, Las Palomas Wildlife Management Area, is in extreme southwest Texas and is divided into three separate small units. Sheldon and J. D. Murphree are the other two state wildlife areas found along the Texas coast (see Visual No. 1).

Louisiana administers four wildlife refuges within its extensive coastal marsh system. Rockefeller Wildlife Refuge - 33,185 ha. It is a major wintering ground for blue and snow geese in the Mississippi Flyway. Mammals found here include muskrats, nutria, deer and rabbits. Extensive impoundments have been constructed to control and regulate water levels. Louisiana State Wildlife Refuge - 6,070 ha. Species include numerous waterfowl, nutria, muskrat and raccoon. Marsh Island Wildlife Refuge - 31,971 ha. It is an important wintering area for blue, snow and Canada geese and contains a large concentration of alligators. St. Tammany Refuge located along the northern shore to Lake Pontchartrain contains 527 ha and provides protection for waterfowl, shorebirds and marsh mammals. Eight additional game management areas located in Louisiana's coastal zone serve primarily as public hunting and fishing areas.

Private wildlife refuges: The National Audubon Society manages the 10,587 ha Paul J. Rainey Wildlife Refuge on the Louisiana coast as well as several tracts in the Texas coastal zone. Some of these are located near state or national wildlife refuges and serve to extend the sanctuary provided by these refuges.

Table II-19 lists the state wildlife management areas and preserves.

Table II-20 identifies the Audubon sanctuaries in Texas, which are also located on Visual No. 1.

State parks: State parks average much smaller in size than the wildlife areas previously discussed and are generally more activity oriented than the national parks. They are numerous and widely distributed along the Gulf coast and serve a large number of people within their localities as well as significant numbers of regional and national visitors.

Collectively the state parks constitute a major part of the recreational resources of the region. Their number and diversity makes generalization difficult. Not only do they vary in size, but their activity and resource orientation varies from fishing causeways through intensively developed recreation sites to scientific, cultural and aesthetic themes.

Table II-21 lists these parks by state. They may also be located on Visual No. 1.

Not listed in the table are three state parks proposed for establishment in Louisiana's coastal area. These three possible additions include Isles Dernieres, Little Chenier (in Cameron Parish) and Chenier-au-Tigre (in Vermilion Parish).

The Cheniere region of southwestern Louisiana offers unique outdoor recreation opportunities. However, access by automobile is quite limited in some parts of the region. Little Chenier is an abandoned beach ridge about 8 km long and up to 46 m wide. This ridge and Chenier-au-Tigre, dominated by moss-covered live oaks offer excellent opportunities for camping, picnicking, and sightseeing from a vantage point which provides a close look at the surrounding marshlands. Two proposed state parks, Chenier-au-Tigre and Sabine Pass are proposed for development along the coast of southwest Louisiana.

Isles Dernieres is a 32 km long chain of barrier islands in Terrebonne Parish. The topography of these islands consists of sandy beaches, low grassy dunes, and sand flats, salt marsh and mangrove swamp. This environment provides a habitat for a wide variety of birds, most importantly herons and egrets. There is no development on the islands other than a large cabin and docking facility in the Whiskey Island group. There are no roads, trails, or utility service. Oil fields surround the islands but there is no industrial activity on the island. Access is possible only by boat or airplane.

The most popular recreational activity on the Isles Dernieres is sport fishing from the beach or offshore in the surrounding waters. Camping, picnicking, and sightseeing are also done but most often in conjunction with sport fishing. Use of the island for other recreation is limited because of limited access and frequent flooding by storm tides.

Local outdoor recreation facilities: In addition to Federal and State recreation areas, there are numerous city and county parks and recreation areas in the coastal zone. These facilities are generally located in and around the major population centers where the demand is greatest. In addition private and commercial recreation facilities

Table II-20. National Audubon Society Sanctuaries in Texas

Name of Area	Hectares
Vingt-et-un Islands of Galveston, Turtle, and East bays	16
Matagorda Island on Wynns Ranch across from Aransas National Wildlife Refuge in Mesquite, Ayres, and San Antonio bays	2,315
Green Island and Three Island Tracts in Laguna Madre	182
Bird Island and North Deer Island in Chocolate and West Bay and the southwest part of Galveston Bay	40
Lydia Ann Island, portions of Harbor Island and small tracts in Copano, St. Charles, Aransas, and Red Fish bays	304
Tract portions of the second chain of islands in San Antonio Bay	32

Source: Texas Parks and Wildlife Department, 1974.

Table II-21. State Parks in the Coastal Area

Louisiana State Parks

Name	Hectares	Name	Hectares
Fort Macomb	7	Edward Douglas White State Monument	2
Fort Pike State Monument	51	Fairview Riverside	41
Longfellow-Evangeline	64	Nibletts Bluff Confederate Memorial	13
Bogue Falaya Wayside Park	5	Grand Isle	57
Fontainebleau	1,115	Cypremort Beach	75
Sam Houston	432	Sabine Pass SCA	18
St. Bernard	145		
Rutherford Beach	N/A		

Total Hectares 2.025*

*excluding Rutherford Beach

Texas State Parks

Name	Hectares	Name	Hectares
Sea Rim State Park	6,044	Sabine Pass Battleground Historic Park (undeveloped)	23
San Jacinto Battlefield State Historic Park	178	Galveston Island State Park	769
Varner-Hogg Plantation State Historic Park	27	Bryan Beach State Recreational Area (undeveloped)	317
Goose Island State Recreation Area	124	Port Lavaca Causeway State Fishing Pier	1
Mustang Island State Park (undeveloped)	1,428	Copano Bay Causeway State Fishing Pier	2
Brazos Island State Recreation Area	87	Lipanitlan State Historic Site	2
		Port Isabel Lighthouse State Historic Structure	1

Total Hectares 9,003

Sources: Texas and Louisiana Statewide Comprehensive Outdoor Recreation Plans, 1976 and 1974.

exist in great numbers. The list could include marinas, public access sites, tennis clubs, amusement parks, resorts, and many others. Due to their large number, small size, and difficulty in obtaining comparable data for the entire Gulf area a complete mapping of these facilities was not attempted. This should not be construed as detracting from their importance in providing the bulk of day-to-day outdoor recreation opportunities for Gulf coast residents.

Recreation beaches: Wherever they are accessible for recreational use the sandy beaches along the Texas and Louisiana coasts are of major recreational importance. These beaches are also potentially vulnerable to offshore oil spills and to direct visual impact from any near-shore structures or lease-generated traffic.

Some information pertaining to the shorelines of Texas and Louisiana, including ownership and usage information, is presented in Table II-22.

The Texas coast has 373 miles (600 km) of shoreline facing the Gulf of which 361 miles (581 km) is beach shore. The much more extensive Bay and estuarine shore has very little beach area. An estimated 270 miles (434 km) of Gulf beach are used for public recreation. The mainland shore is parallelled by barrier islands except at Sabine Pass, the Brazos River delta and the entrances to bays and lagoons. These barrier islands range in width from a few hundred meters to five km and are separated from the mainland by shallow coastal lagoons, five to eight km wide. This double shoreline combined with the subtropical climate and gentle terrain of the region provide conditions favorable for year-round outdoor recreation. As previously mentioned, the Padre Island National Seashore faces the Gulf with about 129 km of excellent beach from Corpus Christi southward. The extensive beaches in the Galveston Island area are some of the most popular along the Texas east coast.

The Texas "open beach law" passed by the Texas Legislature in 1959 provides for public access and use of the beaches having open Gulf exposure from the mean low tide to the vegetation line. Not all beaches are physically suitable for recreation use and there remain some legal questions relating to full public utilization of Texas beaches.

Louisiana has very limited beach area suitable for recreation. The three areas in coastal Louisiana which have experienced the most beach-oriented recreational development are Grande Isle, Vermilion Bay, and the southwest Louisiana coastline between Holly Beach and the mouth of the Mermentau River. Although there are many kilometers of beach shoreline, a large portion of it is very narrow, of poor recreational quality and generally inaccessible. Undeveloped and inaccessible by automobile some of the highest quality beach areas in coastal Louisiana are found along the barrier island chain off Terrebonne Parish. The major island groups encompass Isle Dernieres, a portion of which is a proposed State Preservation Area, and Timbalier Islands.

Sand beaches are identified on Visual No. 1.

Miscellaneous recreation resources: Several additional significant recreational resources are found along the Gulf coast. Louisiana has ornamental gardens, and scenic roads, rivers and trails have been designated in Louisiana and Texas. Fishing piers, many of which have been lighted to facilitate around-the-clock use, have been developed along Gulf frontage in Texas. All the Gulf coastal states possess undeveloped islands of different shapes and sizes displaying a diversity of physical and biological forms. The Bureau of Outdoor Recreation's 1970 publication "Islands of America" inventoried the major islands along the Gulf Coast with primary recreational attributes. Some have since been purchased and included into the nation's public recreation estate.

e. Historical resources

The National Register of Historic Places was the major source consulted for historical sites. The State Historical Preservation Officers for the Gulf States were contacted to determine if any historical or archaeological sites potentially eligible for the National Register are located in the Gulf OCS area. The only known resource at the present time within the area to be affected by this proposed sale is the U.S.S. Hatteras, a Federal Gunboat of Civil War vintage, sunk about 32 km south of Galveston Light. The wreck has been nominated to the National Register.

The National Register of historic sites and the number of recorded archaeological sites in each Gulf coastal county are shown on Visual No. 1.

The following sites are recent additions to the National Register and are not reflected in Visual No. 1:

TABLE II-22.

Gulf of Mexico - Selected Shoreline Information

Location	Physical Characteristics			Shore Ownership			Shore Use			
	Shore Length	Beach Length	Non-Beach Shore	Federal	Non-Federal Public	Private	Public Recreation	Private Recreation	Non-Recreational Devel.	Undeveloped
	(Miles of Shore)									
A. Gulf Shoreline										
Louisiana	810	365	445	160	181.9	468	7.5	2.1	7.2	793.2
Texas	373	361	12	96	12	265	270	41	0	[illegible]
Sub-Total	1,183	726	457	256	193.9	733	277.5	43.1	7.2	855.2
B. Bay and Estuary Shore										
Louisiana	1,133	470	663	85.4	150	897.6	10.3	26.1	39.1	1,057.5
Texas	2,125	16	2,109	292	43	1,790	116	119	107	1,783
Sub-Total	3,258	486	2,772	377.4	193	2,687.6	126.3	145.1	146.1	2,840.5
Total Shoreline	4,441	1,212	3,229	633.4	386.9	2,760.6	303.8	188.2	153.3	3,695.7

Source: U.S. Dept. of Army, Corps of Engineers, 1971.

LOUISIANA	
Episcopal Church of the Epiphany	Iberia Parish
Irish Channel Area Architectural District	Orleans Parish
Isaac-Williams Mansion	Orleans Parish
Jackson Barracks	Orleans Parish
Leeds Iron Foundry	Orleans Parish
Pontalba Buildings	Orleans Parish
St. Vincent DePaul Roman Catholic Church	
Bayou Jasmine Archaeological Site	St. John Baptist Parish
Christ Episcopal Church and Cemetery	
TEXAS	
Point Isabel Lighthouse	Cameron County
King Ranch	Kenedy, Willacy, Nueces and Kleberg Counties
Britton-Evans House	Nueces County
Nueces County Courthouse	Nueces County
George W. Fulton Mansion	Aransas County
Ammon Underwood House	Brazoria County
Antioch Missionary Baptist Church	Harris County
1879 Houston Waterworks	Harris County
Galveston Causeway	Galveston County
Michel B. Menard House	Galveston County
St. Joseph's Church	Galveston County
The McKinney-McDonald House	Galveston County
Frank B. Davison House	Galveston County
Victoria Grist Windmill	Victoria County

Source: Federal Register, 1977. Volume 42, No. 21, Part IX, February 1.

F. ARCHAEOLOGICAL RESOURCES

Evidence of human habitation dating back thousands of years can be found throughout the Gulf states. Archaeological sites are reported in all counties and parishes bordering the coastlines of Texas, Louisiana, Mississippi and Alabama. The total number of sites known and recorded in each county is shown on Visual No. 1.

Because of the sensitive nature of the location of archaeological sites, only those major sites which are of general public knowledge or are afforded protection are individually shown on the visuals. These are certain sites on the National Register of Historic Places.

For the sixteen Texas counties adjacent to the Gulf, 1,359 archaeological sites had been recorded by September, 1974. A total of 43 of these sites had been excavated and an estimated 5% of the total area had been systematically surveyed for archaeological sites. Individual coverage ranged from no systematic survey in Aransas County to approximately 15% coverage in Cameron, Jackson and Kleberg Counties (Texas Archaeological Res. Lab., 1974). There are 594 known sites in Louisiana parishes bordering the Gulf.

Additional discussion of archaeological resources can be found in the Department of the Interior's Final Environmental Statements for OCS Sale No. 38, FES 75-37 (central Gulf), Vol. 1, pp. 237-241; and OCS Sale No. 37, FES 74-63 (western Gulf), Vol. 1, pp. 355-363.

Submerged archaeological sites: There is increasing interest in submerged sites of archaeological value offshore on the continental shelf or in estuaries and embayments. Because man has inhabited the Gulf coast region for thousands of years, there was human occupation in the area at a time when sea level was much lower than it has been within historic times.

Shipwrecks: The waters of the northern Gulf of Mexico contain numerous shipwrecks dating back to the early sixteenth century. Considerable work has been done in the archives of Mexico, Spain and many other countries to identify and locate early casualties in the Gulf of Mexico. More modern losses may be identified by the U.S. Navy, Coast Guard, and insurance company records or other contemporary sources.

A Department of Interior study is nearing completion by Coastal Environments, Inc. (N.D.) to determine the zones of highest probability within the northern Gulf of Mexico for the occurrence of historically significant shipwrecks, as well as the potential for submerged human dwelling sites.

Texas is an area of particularly active shipwreck research. Briggs (1971) lists 83 known wrecks along the Texas coast dating from 1552 to 1897. Mr. Carl Clausen has conducted extensive underwater surveys in Matagorda Bay and along Padre Island for the Texas State Antiquities Commission. A number of the anomalies discovered are believed to be early shipwrecks, and one site, designated 41KN10, was excavated in 1972 yielding artifacts of an early Spanish galleon. However, these surveys, which are being gradually extended along the coast by Mr. J. Barto Arnold for the Texas Antiquities Commission, are conducted close to shore and well within state waters.

4. Transportation

A. GENERAL

The ports and harbors along the Gulf coast from Mobile to Corpus Christi are shown in Table II-23 which show the magnitude of waterborne traffic over the entire area where the oil products originating from the proposed tracts may be transported by barges or tankers.

Of the 462 million tons (419 million metric tons) of freight that passed through the 15 ports and

TABLE II-23

FREIGHT TRAFFIC AT MAJOR PORTS
OF THE GULF COAST, MOBILE - CORPUS CHRISTI

Freight Traffic (Short Tons X 1000)
- 1973 -

Port	Total Freight Traffic	(SIC 13) Crude Petroleum	(SIC 29) Petroleum Products	Total Foreign Trade	Total Petroleum in Foreign Trade	Petroleum Products as a % of Foreign Trade	Petroleum Products in Foreign Trade as a % of Total Port Activity
Mobile	30,518	5,273	3,579	11,766	375	03	01
Pascagoula	12,877	27	6,977	2,891	19	01	00.1
Biloxi	1,246	00	46	00	00	00	00
Gulfport	989	00	32	896	2	00.2	00.2
New Orleans	136,104	23,236	20,925	46,472	3,490	08	03
Baton Rouge	53,568	5,115	15,870	17,442	2,107	12	04
Lake Charles	16,505	7,766	3,763	2,578	1,251	45	08
Orange	1,280	72	61	70	00	00	00
Beaumont	34,491	11,342	13,865	9,618	4,908	51	14
Port Arthur	24,931	7,153	14,905	6,475	4,347	67	18
Houston	88,518	11,390	31,753	33,429	7,371	22	08
Texas City	19,959	4,844	8,728	3,279	2,575	79	13
Galveston	6,887	32	319	5,250	231	04	03
Freeport	7,348	2,410	617	3,420	1,933	57	26
Corpus Christi & Harbor Island	27,171	7,225	3,569	13,067	3,765	29	14
TOTALS	462,392	85,885	130,479	146,833	32,374	22%	07

TOTAL PETROLEUM PRODUCTS AS A % OF TOTAL PORT ACTIVITY 47%

Source: Extracted from U.S. Dept. of the Army, Corps of Engineers, Waterborne Commerce of the U.S., 1973.

harbors in 1973 as shown in Table II-23, 216 million tons (196 million metric tons) or almost 47% were crude oil and petroleum products. Also, of these same 462 million tons of freight, 147 million tons (133 million metric tons), or approximately 32% moved in foreign trade 32 million tons (29 million metric tons) were crude oil and petroleum products.

As shown on General Gulf Visual No. 6, the Gulf Coastal Zone is well served by all forms of transportation. An extensive network of highways and rail lines connect all major ports with inland areas. Transportation throughout the coastal counties is primarily via roads and highways.

Because of their geographic location, the coastal counties are also served extensively by waterborne transportation systems. A number of important U.S. ports are within this Gulf State area.

The Port of New Orleans is the second largest port in the nation, Houston is the third largest and Corpus Christi is the ninth largest U.S. port. The deep water ports along the Texas coastline are Beaumont, Brownsville, Corpus Christi, Freeport, Galveston, Houston, Orange, Port Arthur, Port Isabel, Lavaca, Point Comfort, Texas City and Sabine Pass Harbor.

b. Texas

The principal reference for the following text and figures is Transportation in the Texas Coastal Zone (Texas A & M University, 1973). Much of the following was taken verbatim from that reference.

Highway Transportation

Highways form the backbone of the transportation system serving the land areas within the coastal zone. Most of the 19,308 km of highways crisscrossing the coastal zone are presently operating less than half of their capacity in rural areas; however, traffic volumes increase sharply as these highways approach urban areas.

Rail Transportation

The Texas Coastal Zone is served by an extensive network of railroads that connect the region to the rest of the State and the nation. The 4,809 km of main-line tracks represent more than 21% of all railroad kilometers in Texas.

A total of 55 million tons (50 million metric tons) of rail freight is estimated to originate, terminate, or pass through the Coastal Zone each year. This represents about 28% of all rail freight tonnage reported by Texas railroads. The bulk of this rail traffic is estimated to be in corridors connecting the Coastal Zone to other regions.

The heaviest rail traffic occurs in the corridor connecting Houston to Dallas-Fort Worth area and points north. An estimated 21 million tons (19 million metric tons) per year are carried in this corridor. None of the rail corridors serving the Coastal Zone are presently operating at more than 20 percent of the basic capacity provided by the rail lines.

Air Transportation

Eight airports in the coastal zone are presently served by scheduled air passenger service. Almost three million passengers boarded planes at these airports in 1970.

Pipeline Transportation

The total capacity of pipelines entering or leaving the coastal zone is sufficient to transport more than 150 million tons of crude oil and petroleum products each year. This capacity is distributed among the major corridors as shown in Figure II-20.

Port Facilities and Water Transportation

Texas ports handle three basic types of waterborne traffic: foreign, domestic and internal. Of the total tonnage handled 64% was shipped out, and 36% was received.

Of the ocean traffic, about two-thirds is domestic commerce and the remainder is in foreign trade. The bulk of this outbound tonnage is liquid petroleum products.

The waterway traffic is primarily on the Gulf Intracoastal Waterway, which extends from Brownsville, Texas, to Apalachee Bay, Florida. Its 1791 km of canals, of which 681 km are in Texas, connects all ports on the Gulf of Mexico to more than 9654 km of inland waterway centering on the Mississippi River. Recent industrial expansion in the Texas coastal zone has been closely related to the waterway, as more than four out of every five additional tons of waterborne traffic developed in the past 15 years have been on the canal.

No locks are required through Texas, as all portions of the canal are at sea level. Almost 70 million tons (64 million metric tons) of goods were loaded onto or unloaded off of barges at Texas ports each year from 1967 to 1970.

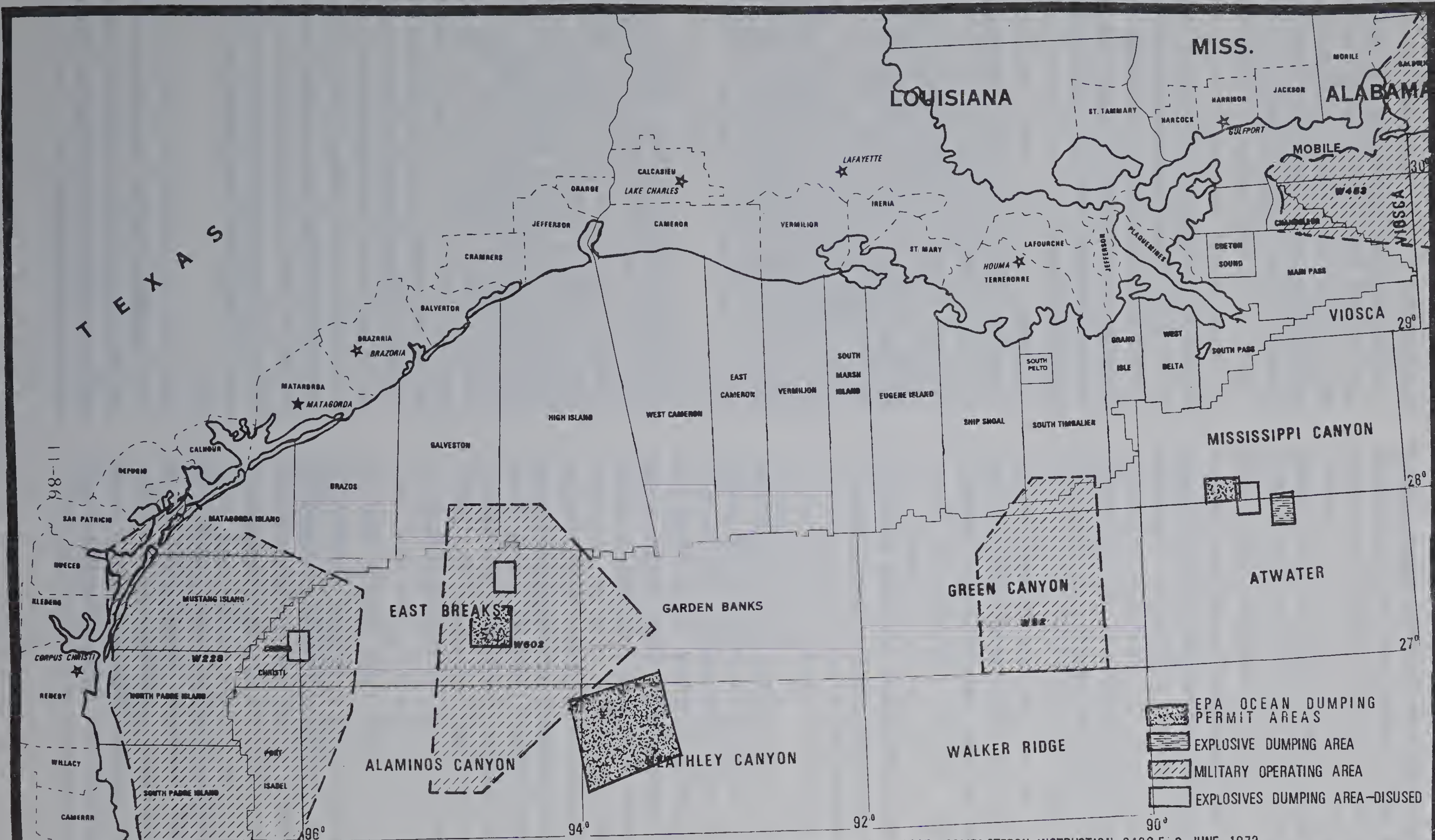


Figure II-19. OCEAN DUMPING AND MILITARY OPERATING AREAS. EPA, DALLAS, TEX., C & GS CHARTS 1115 & 1117, COMEASTFRON INSTRUCTION 3120.5 C JUNE 1972.

About 36 million tons (33 million metric tons) of waterway traffic crossed the Texas-Louisiana border in 1970, about 60% of which was coming into Texas.

Since approximately half of the nation's petrochemical industry and one-fourth of its refining capacity is located in the Texas coastal zone, products from these industries comprise the bulk of total waterborne tonnage for both ocean-going and barge traffic. Of the total tonnage transported on Texas sections of the Intracoastal Waterway, approximately 22% consisted of "Crude Petroleum" (SIC 13), and 33% consisted of "Petroleum and Related Industries" (SIC 29).

Including the petrochemical industry, it has been estimated that approximately 85% of all tonnage handled at Texas ports consists of crude oil or petroleum products (University of Texas, 1973).

The following description of Texas ports was abstracted from a publication by the U.S. Department of the Army (1973).

Port Arthur

The port of Port Arthur has an authorized depth of 13 meters and a width of 244 meters through the outer bar channel and a depth of 12 meters and a width of between 60 and 203 m. The principal waterborne commodities handled at the port are crude petroleum, petroleum products, and chemicals.

Storage facilities include about 25,932,000 barrels of capacity for crude oil and refined petroleum products. Railroad facilities include about three km of marginal trackage. Three federal highways and state highways connect Port Arthur with other parts of Texas and the United States.

Orange

The channel to the port Orange has an authorized depth of nine meters and a width of 46 to 60 m. The principal waterborne commodities handled at the port are shell, crude petroleum, and chemicals. There are 35 piers, wharves and docks.

Storage facilities include transit sheds and about 447,000 barrels of storage capacity for crude oil and refined petroleum products. The Orange area is served by Interstate Highway 10, U.S. Highway 90, two railroad companies and other state highways.

Beaumont

This port has an authorized channel depth from nine to 12 m and a width varing from 60-120 m. The principal waterborne commodities handled at the port are crude petroleum, petroleum products, chemicals, liquid sulphur and wheat.

Storage facilities include elevators for grain, dry storage space, and about a 39,500,000 barrel capacity of storage tanks for crude oil and refined petroleum products. The port area of Beaumont is served by several railway companies. Interstate Highway 10 and several U.S. and state highways connect Beaumont with other points of Texas and the United States.

Galveston

The Galveston Channel has an authorized depth of 12 m and width of 366 m.

Storage facilities include grain elevators, dry storage, cooler and freezer space, storage tanks for liquid sulphur, and storage facilities for an unlimited supply of dry sulphur.

Waterfront terminals at Galveston are served by a railroad which connects with several other railroads serving Galveston and the port area. Interstate 45 and State Highway 87 also connect Galveston with the Texas mainland.

Houston

The Houston Ship Channel affords access for ocean-going vessels from the Gulf of Mexico to Houston. It also provides access to barge traffic from the Gulf Intracoastal Waterway. Some of the principal commodities handled at the port are petroleum and petroleum products, sand and shell, fertilizer and fertilizer materials, steel mill products, grain, sulphur, clay and earths, and chemicals. There are 218 piers, wharves and docks in the vicinity of the port of Houston.

Storage facilities include five grain elevators, 21 warehouses, cooler and freezer space, and about 11,928,000 barrels of storage tanks for crude oil and refined petroleum products. The port area of Houston is served by many railroads. Two interstate highways connect Houston with other points in Texas and other points in the United States.

Texas City

The dimensions of the authorized channel are 12 m deep, 122 m wide, and about six km long, with 12 m depths also authorized for the turning basins and industrial canals.

The harbor area includes about 11,175,000 barrels of storage for crude oil and refined petroleum products. The Texas City Terminal Railway has marginal tracks in the vicinity of the harbor area and connects with other railroads. State Highway 197 connects the Texas City area with other state and Federal highways.

Freeport

The port of Freeport is a major port for shipping chemicals and petroleum products.

Storage facilities include about 20,066 m^2 of transit sheds, private storage facilities for about 700,000 barrels of crude oil, and for about 1,350,000 barrels of petroleum products. Railroad facilities include about 914 m of marginal trackage. Federal and state highways connect Freeport with other parts of Texas and the United States. Port of Port O'Connor

The waterfront facilities in the area, excluding shallow-draft channels, consist of a turning basin with approximately 914 m of usable berthing space and about 2,892 m^2 of transit sheds. There are no storage facilities for crude petroleum. Railroad facilities include trackage connecting to the Missouri-Pacific Railroad. State Highway 35 is the primary highway.

Port of Corpus Christi

Storage facilities include about a 25,430,000 barrel capacity of storage tanks for crude oil and refined petroleum products.

All of the publicly-owned, as well as some of the privately-owned waterfront terminals at the port of Corpus Christi are served by terminal trackage. Several U.S. and state highways connect with other parts of Texas and the United States.

Port of Brownsville

Port Brownsville is the southernmost port in Texas and the southern terminus of the Gulf Intracoastal Waterway System.

The main harbor consists of about 5 km of improved waterfrontage, cargo docks, covered and open storage, and grain storage. Railroad service to the harbor is provided by three companies and it is also served by state and federal highways.

c. Louisiana

The major arteries of Louisiana are the rivers and waterways, and the Mississippi River is the principal route. Southern Louisiana is crossed by Interstate 10 and routes I-12 and I-55 serve the southeastern area. The highway transportation system is supplemented by the intracoastal waterway, air, and rail transportation. The following description of the transportation systems in the Louisiana coastal zone is quoted from the Louisiana Advisory Commission on Coastal and Marine Resources, (1973).

Highway Transportation

In the coastal zone, Louisiana maintains more than 9,700 km of non-rural roadway. The coastal zone also has more than 11,300 km of local rural roads.

The area along the coast generally has suffered from a lack of feeder roads. This is traceable to the fact that soil conditions in the area make road construction costly.

Railroad Transportation

In 1970, there were more than 6,900 km of main line tract in Louisiana.

The primary east-west line in the coastal parishes is Southern Pacific, which runs from New Orleans westward to Morgan City, Lafayette, Lake Charles and ultimately to California. The main line roughly parallels the coast but is located well inland.

The Missouri Pacific traverses an east-west route roughly parallel to U.S. 190.

Texas Pacific serves the western bank of the Mississippi River as far south as Venice, Illinois Central also provides a north-south line from New Orleans to Chicago, Illinois. Southern Railway System and the Gulf, Mobile and Ohio Railroad Company provide north-south service around the eastern end of Lake Pontchartrain. The Louisville and Nashville Railroad provides service from New Orleans eastward along the Mississippi Gulf Coast.

Air Transportation

The coastal zone of Louisiana is served by four commercial airports. They include:

Baton Rouge - Ryan Field
Lafayette - Lafayette Municipal Airport
Lake Charles - Lake Charles Municipal Airport
New Orleans - Moisant (New Orleans International) Airport

Numerous other cities and towns, have unlighted, hard surface, landing strips or airports. However, most of the air facilities are located at least 16 km inland. A number of heliports and seaplane facilities have been constructed on the coast. They are generally concentrated around Morgan City, Grand Isle and Venice and serve the petroleum industry as refueling stops for aircraft transporting workmen to offshore oil rigs from other airports in the more populated areas.

Pipeline Transportation

There are 31 gas transmission companies operating in Louisiana and 34 petroleum and petroleum product pipeline companies. Most pipelines are automated.

That network is likely to grow for natural gas activity and stabilize for petroleum activity based on production predictions prepared by Associated Louisiana Planning Consultants. Incorporated for the Comprehensive State Plan.

Development of a deep-draft port in the Gulf of Mexico vicinity of the Mississippi River may anticipate construction of connector pipelines to the offshore terminal as the main method of moving bulk liquids.

Port Facilities and Water Transportation

At least 8000 km of navigable streams and 1,800 km of intercoastal waterways are located in the state (Louisiana Planning Corporation, 1972. Vol. l, p. 322). These waterways include the Mississippi River and the Gulf Intracoastal Waterway which are major waterways for the nation's waterborne commerce. Other notable waterways include the Calcasieu, Atchafalaya, Ouachita, Mermentau, Vermilion, and Pearl Rivers, Barataria Bay, Bayou Lafourche, the Houma Navigation Canal, the Mississippi River - Gulf Outlet and the Bayous Petit Anse, Tige, Carlin and Teche.

Several major ports have developed in southern Louisiana. Three of these, New Orleans, Baton Rouge, and Lake Charles, rank among the major ports of the United States.

New Orleans is the largest port on the Gulf of Mexico. Upstream from New Orleans on the Mississippi River is the Port of Baton Rouge, the seventh ranked port in the nation in terms of tonnage. Bulk cargoes, petroleum and petroleum products, grains, and ores flow through these ports. Lake Charles, the state's third deepwater port, ranks twentieth in the nation. Lake Charles has bulk cargo operations consisting primarily of petroleum and its derivative products, as well as moderate amounts of general cargo.

The following description of Louisiana ports was abstracted from information from U.S. Department of the Army, 1973.

New Orleans

The Mississippi River has a clear and unobstructed channel maintained to a depth of 12 m from New Orleans to the mouth of the river. The frontage for deepwater vessels within the port limits includes approximately 85 km along the river banks, 8 km on the Inner Harbor Navigation (Industrial) Canal, and approximately 10 km on the Mississippi River - Gulf Outlet. The Inner Harbor Navigation (Industrial) Canal in the City of New Orleans connects the Mississippi River with Lake Pontchartrain, the Mississippi River - Gulf Outlet and the Gulf Intracoastal Waterway east of New Orleans.

There are about 295 piers, wharves, and docks in the Port of New Orleans area. Twenty-three waterfront facilities are equipped to receive and/or ship petroleum products; several of these facilities provide bunkering services for vessels. Four companies maintain facilities for public storage, drumming, blending, packaging and distributing of various types of bulk liquids. They operate six wharves along the right bank of the Mississippi River with waterside connections and pipelines extending to storage tanks in the rear with total storage capacity of about 2,839,000 barrels.

The port area is served by six railway companies. Interstate, Federal and state highways connect New Orleans with other points in Louisiana and the United States.

Baton Rouge

The Port of Baton Rouge, Louisiana, is on both banks of the Mississippi River 418 km from deep water in the Gulf. It is at the head of the deep-draft channel of the Mississippi River. The port is also served by a direct connection with the Gulf Intracoastal Waterway via the Port Allen Lock and the Gulf Intracoastal Waterway Alternate Route which extends from Morgan City to Port Allen. The existing project dimensions above New Orleans are 12 m deep (mean low water) by 152 m wide.

Thirteen waterfront facilities are equipped to receive and/or ship crude oil and petroleum products. There are about 890 storage tanks capable of storing approximately 23,269,999 barrels of crude oil and petroleum products.

The port area of Baton Rouge is served by the Illinois Central Railroad; Louisiana & Arkansas Railway (Kansas City Southern Lines). Interstate,

Figure II-20. **Crude Oil Pipeline Capacities**

Source: National Petroleum Council

Federal and state highways connect Baton Rouge with other points in Louisiana and the United States.

Port of Lake Charles

The port of Lake Charles is in the southeastern part of the State of Louisiana and embraces an area of 526 km^2. The Calcasieu River flows in a southerly direction from the port for a distance of 56 km to enter the Gulf of Mexico.

The existing project provides for a 13 m by 244 m approach channel with a 12 by 122 m channel to the wharves of the port of Lake Charles.

Storage facilities are maintained for about 13,200,000 barrels of crude oil and refined petroleum products. The port area is served by the Kansas City Southern Railway, the Missouri-Pacific Railroad, and the Southern Pacific Company. Interstate Highway 10, U.S. Highway 90 and state highways connect Lake Charles with other parts of Louisiana and the United States.

The Gulf Intracoastal Waterway, which extends from Apalchee Bay, Florida, to Brownsville, Texas, crosses the Calcasieu River about 18 km below the city of Lake Charles. The Waterway section to the east provides a connection with the Mississippi River System at New Orleans, and westward from the Calcasieu River to the Sabine-Neches Waterway.

Intracoastal Shipping

Aside from deep-draft ocean shipping, Louisiana is a key focal point for inland waterway traffic. Inland barge traffic not only links the deepwater ports to the interior of the nation but also provides important support for the industrial structure of coastal Louisiana.

In terms of cargo destined for ocean shipping, the principal commodities carried on the inland waterways are petroleum and petroleum products, grains and grain products, aluminum ores, concentrates and scrap, soybeans, and liquid and dry sulfur. The domestic cargo tonnage moved along Louisiana waterways consists primarily of petroleum and petroleum products, grain and grain products, soybeans, sand, gravel, crushed rock, iron and steel products, sulfur, and other chemicals.

Barge traffic is especially important to the petroleum and chemical industries in Louisiana since it not only supplements pipelines to a considerable extent but also provides low-cost movement of refined petroleum and chemicals to the interior of the nation and to the deep-water ports for trans-shipment. The existence of barge service tends to concentrate petro-chemical facilities adjacent to water sites in Louisiana.

The importance of the petroleum-related industries can be seen in Table II-24. Of the total tonnage handled at the major Gulf Coast ports from Mobile through Brownsville, approximately 22% consisted of "Crude Petroleum" (SIC 13), and 25% consisted of "Petroleum and Related Industries" (SIC 29).

5. Commercial Fishery Resources

A representation of the coastal zone and offshore fisheries is shown on Visual No. 5. In addition, two years (1972-1973) averages for brown, white and pink shrimp are given, and location of royal shrimp grounds, major inshore shrimp areas, major crabbing areas and oyster grounds are illustrated. Finfish are identified as to major species, both sport and commercial, and grid zones in which they are commonly caught. Shell dredging areas are also identified.

By far the most productive fishery region of the Gulf of Mexico, is around the Mississippi Delta, with approximately 1/3 to 2/5 of the total production taken on the eastern side. The total U.S. commercial landings for 1975 were 4.8 billion pounds (U.S. Dept. Commerce, 1975) valued at $970.8. Landings in the Gulf waters of the U.S. accounted for 34.6% or 1.66 billion pounds and 27.9% or $271.1 million of the total U.S. catch.

The Gulf fishery is dominated by the shell fisheries: shrimp, crabs, and oysters (with smaller amounts of clam and scallops), usually worth three or four times more than the much greater volume of finfish. The shrimp fishery in the Gulf area includes brown, white, and pink shrimp. These are taken almost exclusively by trawl fishing, in depths ranging from 2 to 73 meters. Other shrimp taken commercially are the sea bobs and royal reds.

Based on 1973 statistics for grid zones 10-21, brown shrimp (*Penaeus aztecus*) comprised 59% of the catch, white shrimp (*P. setifeus*) 37%, and pink shrimp (*P. duorarum*) 1%. Catches of sea bob (*Xiphopeneus kroyeri*) and the deepwater royal reds (*Hymenpenaeus robustus*) were also reported, and accounted for 3% of the catch. The areas of greatest harvest were grid zones 19, 13, and 14 (Table II-25). The percentage of brown and white shrimp catch for 1970-1974, offshore from the

TABLE II-24.

FREIGHT TRAFFIC AT MAJOR PORTS
OF THE GULF COAST, MOBILE-BROWNSVILLE

Freight Traffic (Short Tons X 1000)
- 1974 -

PORT	TOTAL	CRUDE PETROLEUM (SIC 13)	PETROLEUM PRODUCTS (SIC 29)
Mobile	33,154	4,488	3,379
Pascagoula	13,073	1,425	7,208
New Orleans	144,189	23,742	22,826
Baton Rouge	59,126	6,491	17,030
Lake Charles	16,546	7,858	4,020
Orange	1,331	50	62
Beaumont	33,504	12,899	12,089
Port Arthur	27,799	10,302	13,915
Houston	89,106	18,809	30,273
Texas City	20,152	6,273	7,392
Galveston	7,171	209	149
Freeport	8,898	3,065	1,176
Corpus Christi and Harbor Island	37,781	13,077	13,076
Brownsville - Port Isabel	2,837	379	644
TOTALS	494,667	109,047	133,229

Compiled from figures in U.S. Department of the Army, 1974.

Table II-25. Shrimp Catch by Grid Zone for 1975[1/]

Species	GRID 11	12	13	14	15	16
Brown	3,999,504	79,553	3,343,108	1,818,594	1,342,067	971,374
White	804,273	54,403	1,351,997	878,035	4,801,342	2,582,528
Pink	3,073	-	-	1,026	-	-
Other	24,982	5,410	554,538	314,666	1,929,487	92,385
TOTAL	4,831,832	139,366	5,249,643	3,012,321	8,072,896	3,646,287
Trips	2,840	65	6,040	2,024	5,351	2,643

Species	GRID 17	18	19	20	21
Brown	1,700,148	4,026,618	6,712,688	7,769,969	6,215,611
White	2,824,342	2,138,499	1,545,304	388,996	79,913
Pink	550	-	-	555	-
Other	799,436	22,718	36,858	-	-
TOTAL	5,324,476	6,187,835	8,294,850	8,159,520	6,295,524
Trips	7,146	6,660	6,482	3,995	2,612

1/ Includes inland waters; weight in pounds (heads off).

Source: Gulf Coast Shrimp Data Summary, U.S. Dept. of Commerce, 1976.

Mississippi River to Texas are shown in Tables II-26 and II-27.

Table II-28 is a statistical summary of commercial fishery landings, fisherman, plants, and ranking States for the Gulf States.

In 1974, the Gulf States shrimp fishery accounted for 50% of the total value. Texas was again the leading state in value with $67.7 million, and the second state in production with 78.7 million pounds. Louisiana was second in value with $32.1 million, and third in production with 59.5 million pounds.

Compared with 1973, landings along the Gulf coast of 185.7 million pounds increased 2% but the value ($137.4 million) declined 21%. For oyster production, Louisiana led with 9.0 million pounds, followed by the west coast of Florida with 2.4 million and Texas with 1.3 million pounds. The oyster harvest declined generally in the Gulf area, principally because of floods in 1972 and 1973.

Louisiana also led in crab production with 20.6 million pounds. Production for the Gulf states was 39.6 million pounds which represented 6% less than in 1973.

Finfish volume for the Gulf states is dominated by menhaden. It is number one in both volume and value for the Gulf States. Landings in 1974 were 1,196.9 million pounds or 66.3% of the U.S. menhaden catch, most of which is landed at Louisiana ports.

Gunter (1967) indicated that 97.5% of the total commercial fisheries catch of the Gulf states is made of estuarine species, that is, fishes or shell fishes that spend all or part of their lives in estuaries. A few species, such as the commercial oyster, live their lives in estuarine waters.

On the Gulf coast as a whole, the usual ranking of the most important commercial fishes is as shown below:

Table II-26. PERCENT BROWN SHRIMP LANDINGS (LBS.) BY WATER DEPTH, 1970-1974, OFFSHORE - MISSISSIPPI RIVER TO TEXAS

Depth (ft.)	1970 %	1971 %	1972 %	1973 %	1974 %	1975 %
0-60	24.63	33.87	23.01	37.17	20.75	9.38
60-120	28.24	35.74	22.66	8.73	23.74	46.07
120-180	34.67	18.96	35.39	16.3	29.83	34.29
180+	12.45	11.42	18.95	37.34	25.69	10.26

Source: Gulf Coast Shrimp Data, Summary
U. S. Department of Commerce, 1976

Table II-27. PERCENT WHITE SHRIMP LANDINGS (LBS.) BY WATER DEPTH, 1970-1974, OFFSHORE - MISSISSIPPI RIVER TO TEXAS

Depth (ft.)	1970 %	1971 %	1972 %	1973 %	1974 %	1975 %
0-60	85.04	89.53	90.61	94.85	91.55	93.60
60-120	14.03	9.55	8.80	4.78	6.65	5.86
120-180	0.87	0.83	0.44	0.22	1.67	0.49
180+	0.07	0.09	0.15	0.17	0.12	0.05

Source: Gulf Coast Shrimp Data, Summary
U. S. Department of Commerce, 1976

TABLE II-28. Landings by States for Gulf of Mexico 1974-1975[1/]

	1975				1974			
	Thousand Pounds	%	Thousand Dollars	%	Thousand Pounds	%	Thousand Dollars	%
Gulf (includ. Fla.)	1,663,419		271,137		1,772,531		240,836	
Louisiana	1,124,586	68	88,245	33	1,228,906	69	86,694	36
Texas	88,507	5	93,163	34	97,203	6	72,455	30

Ranking in U.S. (1975) by Landings

State	Catch	Value
Louisiana	1	3
Texas	11	4

Number of Full-Time and Part-Time Commercial Fishermen[2/] 1975

State	Full-Time	Part-Time	Total
Louisiana	10,100	4,000	14,100
Texas	6,300	600	6,900

Processing and Wholesale Establishments, 1974

		Employment	
State	Plants	Season	Year
Louisiana	211	4,685	3,311
Texas	150	3,657	2,023

Plants Producing Canned Fishery Products, Industrial Products, and Fish Fillets and Steaks, 1975.

State	Canned Fishery Products	Industrial Fishery Products	Fish Fillets & Steaks	Total Plants
Louisiana	16	19	1	26
Texas	-	1	-	1

Source: U.S. Department of Commerce, 1976, Fisheries of the U.S. 1975 - Current Fishery Statistics No. 6900

1/ Landings in interior waters are estimated
2/ All data are estimated

H. Existing Environmental Quality

1. Air Quality

Multiple or massive use of air for waste disposal (emissions) in a limited area temporarily degrades the quality (defined as availability for general use) of the air. Evaluation of the potential impact of a proposed additional use of air involves knowledge of the restrictions on additional impacts, the capability of the air to receive additional impacts and the extent of the proposed additional impacts. The remainder of this section examines the first two factors in terms of the legal constraints involved and the existing air quality.

Interstate air quality control regions define areas in which specific controls and standards are applied but which are administered by Federal and State jurisdictions. The air quality criteria to be met by a potential pollution source can be complex in that each air quality jurisduction may have differing criteria. Thus, conceivably, a source in the Houston, Texas, area would have to meet separate criteria imposed by the Federal standards (through EPA Region VI), Texas Air Control Board (Texas Region VII), Harris County Division. Table II-29 lists the Federal ambient air standards. All individual states are required to adopt standards as stringent as or more stringent than the Federal standards.

Rather than detail such emissions data, the potential user is referred to the SAROAD system of the Environmental Protection Agency. This provides access to all current and past air quality data, and may be assessed through a specific geographic location.

A high carbon monoxide emission level is indicative of high automotive density; and a high hydrocarbon level may indicate petroleum, storage, refining, or other petroleum-related activities.

The quality of air over the proposed area can be degraded from several types of sources including exhaust emissions from stationary power units, service vehicles and by accidental release and combustion of oil or gas. Because of the distance of most of the operating facilities in the nearshore tracts air quality degradation could result. To determine the specific effect of emissions on particular areas reference is made to the EPA publication of "Compilation of Air Pollution Emission Factors", 1975.

The Texas Implementation Plan of 1972 indicated some difficulties in several Air Quality Control Regions (AQCR's). The following table indicates the priorities assigned to these coastal regions for specific pollutants. Priority I indicates measurements above the primary standards and the requirements for controls to reduce pollutant concentrations.

Therefore, in light of the above data, it is recognized that there is a severe air quality problem along the Texas coast. Since the Texas Implementation Plan, 1972 new and more improved measurement methods have been developed. Texas has a severe ozone problem and these methods allow for a more accurate recording of the ozone levels in the AQCR's.

The standard does not allow the ozone level to exceed 0.08 parts per million (ppm) for more than one hour in a calendar year. The majority of the measurements have been made in the upper Gulf Coast area of Texas. This is the region where most of the petrochemical industries and metropolitan areas are concentrated.

Ozone concentrations vary according to such things as: time of day, season, and weather conditions. During the sunlight hours and the sunny summer months the ozone level increases. Weather also plays a major role in ozone production. High winds usually keep ozone low while relatively stagnant air is conducive to high ozone levels.

The highest ozone level recorded in Texas was 0.42 ppm, measured in August of 1972 in Houston. In every major city in the state where the monitoring of ozone was conducted it showed a high and second high hourly value in excess of the standard of 0.08 ppm at one time or another in the year. However, in the 21,000 hours of monitoring only 700 recordings showed levels in excess of 0.08 ppm. This indicates the total ozone exposure experienced by Texans is low despite the occasionally high levels.

Table II-29. FEDERAL AMBIENT AIR QUALITY STANDARDS

Parameter	Standard Primary	Secondary
Particulate Matter:		
Annual geometric mean	75 ug/m^3 1/	60 ug/m^3
24-hour maximum	260 ug/m^3	150 ug/m^3
Sulfur Oxides:		
Annual arithmetic mean	80 ug/m^3	
24-hour maximum	365 ug/m^3	
3-hour maximum	--	1.300 ug/m^3
Carbon Monoxide:		
8-hour maximum	10 mg/m^3 2/	10 mg/m^3
1-hour maximum	40 mg/m^3	40 mg/m^3
Photochemical Oxidants:		
1-hour maximum	160 ug/m^3	160 ug/m^3
Hydrocarbons:		
3-hour maximum	160 ug/m^3	160 ug/m^3
Nitrogen Dioxide:		
Annual arithmetic mean	100 ug/m^3	100 ug/m^3

1/ ug/m^3 = micrograms per cubic meter

2/ mg/m^3 = milligrams per cubic meter

Source: Air Quality Data - 1973 Third Quarter Statistics EPA, 1974.

Table II-30. State Ambient Air Quality Standards that are More Stringent than Federal Air Quality Standards

Texas	
Suspended Particulate Matter	
Maximum consecutive 5-hour mean	100 $\mu g/m^3$ (a)
Maximum consecutive 3-hour mean	200 $\mu g/m^3$ (a)
Maximum consecutive 1-hour mean	400 $\mu g/m^3$ (a)
Sulfur Dioxide (SO_2):	
Maximum 30-minute mean	0.4 ppm (b)(c)
Louisiana	
Dust fall	20 tons per square mile per month
Coefficient of Haze	
Annual geometric mean	0.6 COH/1000 lin.ft.
Annual arithmetic mean	0.75 COH/1000 lin.ft.
Maximum 24-hour mean	1.50 COH/1000 lin.ft.
Sulfuric Acid Mist: (Sulfur Trioxide, or any combination thereof)	
Maximum annual mean	4 $\mu g/m^3$
24-hour mean	12 $\mu g/m^3$
1-hour mean	30 $\mu g/m^3$

(a) solid fossil fuel fired steam generators excepted

(b) 0.28 ppm (part per million) for Harris and Galveston Counties

(c) 0.32 ppm for Jefferson and Orange Counties

2. Water Quality

The Gulf states—Texas, Louisiana, Mississippi and Alabama are presently developing Water Quality Management Plans pursuant to Section 303e of the 1972 Amendments of the Federal Water Pollution Control Act (P.L. 92-500). The purpose of these plans are twofold: to provide an analysis and assessment of the present environmental conditions and stresses within basins; and to provide a qualification of the waste waters. The basin plans may affect local water pollution control activities by identifying polluted waters, establishing maximum pollution loads which may be discharged into waters, identifying waste water treatment plants which are discharging more BOD (Biological Oxygen Demand) that the waters can safely accept, and suggesting measures which would correct local water pollution problems. The 1972 amendments to the Federal Water Pollution Control Act also requires that every "point source" discharge of pollutants to obtain a permit which specifies the allowable constituents and amounts of its effluent (CEQ, 1974). Those with ocean outfalls are required to comply with criteria set out in the Marine Protection, Research and Sanctuaries Act of 1972. This permit program is administered by EPA or by authorized states that have met certain requirements.

Each state is divided into hydrological units (basins). These are further divided into sub-basins. The segments of each basin have been analyzed in detail for water quality, and the existing state standards and classification of surface water and segment categorization are evaluated for each segment.

The sub-basins are classified as either water quality of effluent limited. The water quality segments require a significant point source of non-point source to be controlled beyond the best practical treatment or secondary treatment to achieve standards. The effluent limited segment is and will continue to meet water quality standards by the "best practicable control technology" or secondary treatment for publicly owned facilities.

Some of the types of pollutants that enter the water from non-point sources include soil particles, nutrients, organic matter, microscopic organisms, inorganic matter, heavy metals, chemicals and pesticides. The erosion of soil particles is a major single pollution source. The majority of non-point pollution can be attributed to erosion areas, intense agricultural practices and construction in highly populated areas.

In implementing the plan for waste load allocation, effluent discharge parameters for individual point source discharges have been established. These effluent limitations are quantities, rates and concentrations of chemical, physical, biological and other constituents that are discharged into navigable waters, waters of the contiguous zone, or the ocean. In determining the maximum allowable wasteloads of BOD an analysis of the assimilative capacity of the receiving stream is calculated. The reasonable background values are defined as: DO (Dissolved Oxygen) 85% saturation, TKN (Total All Killed Nitrogen) 1.3 mg/l maximum; BOD 4 mg/l. Significant point source discharges are any discharges that have effluent of 100,000 gallons per day or more and/or discharges that are associated with a significant water quality violation problem. Since each state presents water quality data differently they are considered separately. The preceding information was largely taken from the water quality basin plans for the Gulf Coast. These plans were submitted in accordance with the 1972 Federal Water Pollution Control Amendments (P.L. 92-500, Sec. 303e).

Texas has extensive data available for each water quality basin. Water quality management plans have been prepared in compliance with the 1972 amendments to the Federal Water Pollution Control Act (P.L. 92-500). These reports along with recent stream monitoring data show the actual quality of coastal streams and estuaries and are available from the Texas Water Quality Board. Following is a brief summary of the water quality of the Texas coastal basins. Table H-31 indicates the segment classification, state ranking, number of discharges and the actual flow of waste effluent (MGD).

NECHES—TRINITY COASTAL BASIN

Segment 2411 (*Sabine Pass*)—This segment is designated as effluent limited.

Segment 2412 (*Sabine Lake*)—The only problem found in this segment was a fecal chloroform count. Corrective measures are being undertaken to alleviate this problem.

Segment 2423 (*East Bay*)—There are neither any point source dischargers nor water quality problems in this segment.

TRINITY—SAN JACINTO COASTAL BASIN

Segment 2422 (*Trinity Bay*)—This is a highly productive estuarine ecosystem in the Galveston

Table II-31.

Segment Summary for Texas Coastal Basins

Segment	Name	Classification	State Ranking	Discharges Municipal	Discharges Industrial	Other	Waste Effluent Daily Flow MGD
			Neches - Trinity Coastal Basin				
2411	Sabine Pass	EL	204	0	0	0	0
2412	Sabine Lake	EL	93	1	0	0	uk
2423	East Bay	EL	272	0	0	0	0
			Trinity - San Jacinto Coastal Basin				
2422	Trinity Bay	EL	284	9	1	0	uk
2426	Tabbs Bay	WQ	60	2	3	0	3.89
2428	Black Duck Bay	EL	78	0	0	0	0
2429	Scott Bay	WQ	62	0	3	0	0.86
2430	Burnett Bay	WQ	63	2	1	1	0.75
			San Jacinto - Brazos Coastal Basin				
2421	Galveston Bay	EL	184	24	23	2	16.57
2424	West Bay	EL	192	4	1	0	0.524
2425	Clear Lake	EL	121	10	5	0	4.19
2427	San Jacinto Bay	WQ	61	2	10	3	9.77
2431	Moses Lake	EL	166	1	4	1	1.06
2432	Chocolate Bay	EL	226	2	0	0	1.96
2433	Bastrop Bay	EL	118	0	0	0	0
2434	Christmas Bay	EL	115	0	0	0	0
2435	Drum Bay	EL	98	0	0	0	0
2436	Barbours Cut	WQ	64	0	0	0	0
2437	Texas Ship Channel	WQ	40	0	19	1	76.5
2438	Bayport Channel	EL	168	0	1	0	4.4
			Brazos - Colorado Coastal Basin				
2441	East Matagorda Bay	EL	70	2	0	0	3.5

Table II- 31 (cont.)

Segment	Name	Classification	State Ranking	Discharges Municipal	Discharges Industrial	Discharges Other	Waste Effluent Daily Flow MGD
		Colorado-Lavaca Coastal Basin					
2451	Matagorda Bay	EL	84	1	0	0	0
2452	Tres Palacios Bay	EL	105	2	0	0	0.21
2453	Lavaca Bay	WQ	19	5	12	0	26.89
2454	Cox Bay	EL	71	1	1	3	217.51
2455	Keller Bay	EL	73	0	0	0	0
2456	Carancahua Bay	EL	135	0	0	0	0
		Lavaca-Guadalupe Coastal Basin					
2461	Expiritu Bay	EL	70	0	0	0	0
2462	San Antonio Bay	EL	142	3	0	0	0.07
		San Antonio-Nueces Coastal Basins					
2463	Mesquite Bay	EL	74	0	0	0	0
2471	Aransas Bay	EL	96	2	0	0	0.6
2472	Copano Bay	EL	163	1	0	2	0
2473	St. Charles Bay	EL	117	3	0	0	0
2481	Corpus Christi Bay	WQ	39	10	7	3	189.59
2482	Nueces Bay	EL	123	2	4	1	4.32
2483	Redfish Bay	EL	83	2	0	1	1.05
		Nueces-Rio Grande Coastal Basin					
2484	Corpus Christi Inner Harbor	WQ	37	1	18	4	89.26
2491	Laguna Madre	EL	75	43	13	3	0.61
2492	Baffin Bay	EL	79	15	3	5	10.64
2493	South Bay	EL	77	1	0	0	0
2494	Brownsville Ship Channel	EL	82	14	1	1	210.00

Source: State of Texas Water Quality Inventory 2nd Edition. 1976

Bay complex. Excessive fecal chloroform and pH levels are the only violations.

Segment 2426 (*Tabbs Bay*)—This system is greatly influenced by adjacent segments and exhibits potential problems associated with high pH and fecal chloroform levels. In order to restore and maintain water quality standards modifications to existing wastewater treatment plants are necessary. This segment falls into the water quality class.

Segment 2428 (*Black Duck Bay*)—There are no point source discharges in this segment, the major flow is from overland run-off. A portion of the Bay is used as an oxidation pond and may be a potential water quality problem.

Segment 2429—2430 (*Scott Bay and Burnett Bay*)—These segments have high fecal chloroform content and pH level and therefore have been classified as water quality.

San Jacinto—Brazos Coastal Basin

Segment 2421 (*Galveston Bay*)—This system provides a nursery for a large percentage of shrimp and commercial and sport fish taken from the Texas coast, and contributes to over half of Texas' oyster production. There are 17 domestic and 22 municipal discharges. All standards for this segment are being met except for fecal chloroform and pH. This has resulted in a closing of nearly half of Galveston Bay to shell fishing.

Segment 2424 (*West Bay*)—The upper portion of this drainage is agricultural with some drainage for development areas, the lower portion is marsh land. Fecal chloroform and high pH exists in this segment.

Segment 2425 (*Clear Lake*)—Clear Lake is presently classified as effluent limited, however, it should be reclassified as a water quality segment. The water quality problem in this segment is associated with high fecal chloroform counts, low dissolved oxygen concentrations and hypereutrophication. Advanced wastewater treatment processes are necessary to counter balance the high eutrophication input by limiting the nutrient inflow.

Segment 2427 (*San Jacinto Bay*)—This segment is influenced by direct wastewater discharge and indicates a potential water quality problem associated with fecal chloroform and pH. The classification for this segment is water quality.

Segment 2431 (*Moses Lake*)—This segment has exhibited high fecal chloroform counts which are due to septic tanks in the immediate area, tributaries to this area, and waste discharges from boat traffic.

Segment 2432 (*Chocolate Bay*)—There are three domestic wastewater treatment plants in this segment, two of which are in violation of the water quality standards. There is a high fecal chloroform level the source of which is presently being studied.

Segment 2433, 2434 and 2435 (*Bastrop Bay, Christmas Bay and Drum Bay*)—do not have any point source discharges. These segments have been designated as effluent limited.

Segment 2436 (*Barbour's Cut*)—There are no point source discharges within this segment, and it has been classified as effluent limited.

Segment 2437 (*Texas Ship Channel*)—This segment has been classified as water quality limited. There are 19 industrial discharges, all of which are involved in the petroleum industry, and one of which contributes more than 97% of the total BOD load.

Segment 2438 (*Bayport Channel*)—The water quality of this segment is influenced by waste effluent from an industrial discharger and also the tidal action. The segment has been classified as water quality limited as a result of a single low DO reading. It has been recommended that this segment be reclassified to effluent limited.

Brazos—Colorado Coastal Basin

Segment 2441 (*East Matagorda Bay*)—There are two permitted discharges in this segment. Both of these dischargers are in compliance with the state water quality standards.

Colorado—Lavaca Coastal Basin

Segment 2451 and 2452 (*Matagorda Bay and Tres Palacios Bay*)—The water quality in these coastal basins are good and has been classified as effluent limited.

Segment 2453 (*Lavaca Bay*)—This segment has 17 point source dischargers, five municipal dischargers and 12 industrial dischargers. Several are presently discharging an effluent that violates the water quality standards. Several industrial facilities are also discharging effluents that violates the standards. Lavaca Bay is classified as water quality due to the repeated violation of fecal chloroform and DO standards.

Segment 2454, 2455 and 2456 (*Cox Bay, Keller Bay and Carancahua Bay*)—do not have any point source dischargers. These segments do not have any water quality problems and are classified as effluent limited.

LAVACA—GUADALUPE COASTAL BASIN

Segment 2461 (*Espiritu Bay*)—There are no dischargers in this segment. It has been classified as effluent limited.

Segment 2462 (*San Antonio Bay*)—This segment consists of estuarine waters that have environmental and ecological significance and is used as a wildlife habitat. San Antonio Bay has proven to be a valuable area in which to mine oyster shell, and adjacent to this segment is the Aransas National Wildlife Refuge. This segment does not have any water quality problems. The prevention of poor dredging practices in known sensitive areas within this segment will insure the continued value of the waterway.

Segment 2463 (*Mesquite Bay*)—This segment is rated as effluent limited and all measured parameters are well within standard requirements. The direct and regular exchange of water between the Gulf of Mexico via Cedar Bayou Pass accounts for its relatively high quality. The primary land use in this segment is a refuge for wildlife. There are no discharges into this segment.

Segment 2471 (*Aransas Bay*)—There are no noncompliant parameters related to established standards in this segment and therefore is classified as effluent limited. Aransas Bay is a valuable fish and wildlife production area, especially as a shrimp nursery. The growing concern in this area is the establishment of residential and resort activities as inadequate private wastewater treatment is a threat to the quality of water in this segment.

Segment 2472 (*Capano Bay*)—The primary use of the water in this segment is recreational. There is only one discharger presently and the segment is classified as effluent limited.

Segment 2473 (*St. Charles Bay*)—This is a fish and wildlife habitat and breeding area, and the Aransas Wildlife Refuge surrounds the Bay. This segment is presently classified as effluent limited. However, there are some principal threats to the environment: 1) shoreline alteration practices, ex: filling for construction; 2) water circulation pattern alternations and 3) inadequate private wastewater facilities.

Segment 2481 (*Corpus Christi Bay*)—This segment has the 19 point sources dischargers. There is also a problem of non-point source dischargers resulting from urban runoff. The principal problems occur from the modification of water circulation patterns by dredged material accumulation. There is presently a potential heavy metal problem in this harbor which is being studied. This segment has been classified as water quality.

Segment 2482 (*Nueces Bay*)—This is a valuable marine life nursery area. It is also a valuable area of sport and commercial fishing. The principal threats to the bay are bay volume reduction (caused by deposition of dredged material) and salinity and temperature change. This segment has no water quality problems and has been designated effluent limited.

Segment 2483 (*Redfish Bay*)—This is one of the two primary marine life migration portals in this portion of the Texas coast. It is also a wildlife habitat area and aquatic nursery for turtle and mangrove grass flats. Alterations of water circulation patterns through placements of dredged material and channelization in this segment could have a significant effect on marine life.

NUECES—RIO GRANDE COASTAL BASIN

Segment 2484 (*Corpus Christi Inner Harbor*)—This segment is used primarily as a ship channel and is the economic center of the metropolitan area. There are 14 industrial and one municipal wastewater treatment plants. The segment has been classified as a water quality segment based on pH data; as a result an intrusion study was undertaken. It was found that the zone of oxygen depletion which extends along the western harbor area is primarily attributable to algal photosynthesis and the oxygen demand of the deposited sediments rather than wastewater discharges. There is presently a potential heavy metal problem in this harbor which is being studied.

Segment 2491 (*Laguna Madre*)—This area has special ecological significance because it is an active fish and wildlife habitat and breeding area. The segment is designated as effluent limited and there are no indications of water quality problems.

Segment 2492 (*Baffin Bay*)—This segment has been classified as effluent limited. The majority of the point sources which discharge into this bay are from municipal dischargers.

Segment 2493 (*South Bay*)—There are no point source dischargers in this segment and no water quality problems.

Segment 2494 (Brownsville Ship Channel)—The industrial and commercial development along the channel is not as dense as other major ports and therefore the water quality problems are not as evident in this segment.

At present, little data is available from state sources for Louisiana. Most of the data available pertains to point sources of pollution and amount of discharge.

Tables II-32 summarizes water pollution data for the coastal counties of Louisiana.

The areas where water quality standards are not being met are the major metropolitan areas of the coast and also in the areas of concentrated petrochemical industries.

Table II-32. Municipal and Industrial Effluents for Louisiana Coastal Parishes

Parish	Industrial M.G.D. 1/	Municipal M.G.D.
Calcasieu	419.2	10.7
Cameron	0.2	0.2
Iberia	---	0.2
Jefferson	288.0	3.5
La Fourche	266.0	---
Orleans	81.5	80.5
Plaquemines	161.0	3.0
St. Bernard	7.2	12.8
St. Mary	---	4.1
St. Tammany	---	1.3
Terrebonne	0.7	5.6
Vermilion	---	1.2

1/ M.G.D. - million gallons per day

Source: Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana, 1971.

I. Historical and Projected Economic Growth

1. Introduction

The acreage proposed to be offered in Lease Sale No. 45 is located on the Outer Continental Shelf within an area extending from Brownsville, Texas to Eastern Louisiana.

The areal extent of the industrial and economic effects that may result from this proposed sale are difficult to delineate due to the fact that the Gulf of Mexico area is already a major supplier of crude oil, petroleum products and natural gas to other regions of the United States. The following discussion is limited to the onshore areas adjacent to the proposed sale region since the initial economic effects may be assumed to impinge on these sectors.

Additional discussions of the economy in the states adjacent to the Gulf of Mexico have been published in the following environmental statements:

Final Environmental Statement, FES 74-63, OCS Sale No. 37, Offshore Central Gulf.
Final Environmental Statement, FES 75-37, OCS Sale No. 38, Offshore Central Gulf.
Final Environmental Statement, FES 75-61, Outer Continental Shelf, Programmatic.
Final Environmental Statement, FES 75-101, OCS Offshore Gulf of Mexico, Sale No. 41.
Final Environmental Statement, FES 76-46, OCS Sale No. 44, Offshore Central and Western Gulf of Mexico.
Final Environmental Statement, OCS Sale No. 47, Offshore Central and Western Gulf of Mexico.

The economic activity that has occurred in the coastal areas bordering the Gulf of Mexico has been a significant part of the total economic activity of the nation.

The states bordering the Gulf of Mexico include Texas, Louisiana, Mississippi, Alabama and Florida. For purposes of this discussion, the coastal area of Texas will be considered to be the western Gulf of Mexico region, the coastal portion of Louisiana will be considered to be the central Gulf of Mexico region.

The historical changes that have occurred within the economies of the states bordering the Gulf of Mexico are summarized in the following sections. These descriptions were based on statistical data provided in the Texas Almanac, 1974-1975, published by the A. H. Belo Corporation and publications of the Research Department of the Federal Reserve Bank of Atlanta (1972), supplemented by additional information relating to current economic conditions.

a. Texas

Selected portions of the economic activity for Texas are presented in Table II-33.

During 1976, approximately 450,000 workers were employed in the manufacture of durable goods, and approximately 374,000 were employed in manufacturing nondurable goods.

Employment in wholesale and retail trade amounted to approximately 951,000 persons in 1972. Employment in water transportation amounted to approximately 21,000, and employment in pipeline transportation amounted to approximately 5,000.

The recent changes in the economy of the State of Texas have been summarized by Monti.

"Texas has been insulated from both the sharp drop of the recession and the consequent rapid rise of the recovery, with the result that employment in Texas dropped less and began to recover earlier than elsewhere in the nation. Less decline also means less recovery. The past years' improvement in Texas in nonagricultural employment was 2.7% from July 1975 to July 1976, while the comparable figure for the U.S. was 3.8%. Likewise, parts of Texas that showed the least improvement over the past year were those that had dropped the least in employment. Conversely, high rates of manufacturing employment growth have occurred in the labor market areas in Texas and still have the highest rates of unemployment—Laredo and McAllen-Pharr-Edinburg. Low unemployment areas occurred among those with low growth" (Monti, 1976a).

Areas with below average growth in manufacturing included the areas dependent on oil-related manufacturing, notably the Houston area. During recent months, declines in industrial production in the Houston area were reflections of declines in oil field machinery manufacturing and other oil-related manufacturing. Other changes noted were that areas that are expanding manufacturing are not the traditional manufacturing-dependent cities. Manufacturing jobs are occurring outside the two major urban areas in the state.

Other observations of the current changes include, low unemployment rates are associated with both high and low growth rates of manufacturing employment during the past year, an indication of both high and low sensitivity to national economic trends. The low unemployment areas have developed as service and trade centers for oil drilling and agriculture, with some manufacturing and Federal government employment.

Table II-33. Economic Activity in Texas

	1962	1972
Per capita personal income	$ 2,027	$ 4,045
Total personal income	$20,518	$47,121 (million)
Total cash farm income	$ 2,575	$ 3,722 1/ (million)
Cash farm receipts from crops	$ 1,352	$ 1,132 (million)
Cash farm receipts from livestock and products	$ 1,075	$ 2,122 (million)
Petroleum production	943	1,301 2/ (mil. bbls.)
Value of construction	1,132	1,751 1/
Manufacturing employment	497	741 (thousand)
Construction employment	---	238 (thousand)

Source: Texas Almanac, 1975.

1/ 1971

2/ Crude production appears to have peaked during 1974.

The local economies in oil-based manufacturing areas, such as Houston, Beaumont-Port Arthur-Orange, and Galveston-Texas City are anticipated to follow trends different from the national trends.

A discussion of economic trends within Texas was included in a recent issue of the Texas Business Review.

"It is widely accepted that the U.S. has recently entered a "post-industrial" stage of economic development. Generally, post-industrial means that a few workers provide the physical goods for the rest of the population. If productivity per worker on farms, in oil refineries, and in steel mills is high, only a small percentage of the employed will produce all of the goods for the nation. The rest of the employed will move, sell, count, or analyze the output of the production workers or perform services—legal, medical, educational, governmental and personal, (Monti, 1976b)."

The article noted that oil, gas, and petrochemicals, the first large industries in Texas, produced very high value added per worker, since in this sector of the economy equipment, rather than people, produced the goods, and therefore, the oil, gas, and petrochemical sector of the Texas economy has been "post-industrial" for several decades. Population and manufacturing have been drawn to Texas by the presence of oil and space. The growth of oil fields and accompanying industries stimulated the development of Texas before World War II. Space and climate were cited as reasons for the establishment of military bases and the aircraft industry in Texas as well as other southern states, leading to increases in construction activity and the provision of services, and to manufacturing. The southward movement is still continuing. The article employed the cluster analysis technique, which classifies regions of the U.S. according to measures of income derived from basic industries, to examine individual counties in Texas. All sources of income were used in this analysis, and distinguishing sources of personal income for the year 1973 identified for each county.

The results of an application of the technique to changes in income between 1969 to 1973 revealed that above average changes in personal income were generally associated with growth in trade and government services.

Thus far in 1976 the Texas building construction industry has been experiencing a relatively strong recovery. On a statewide basis dwelling unit authorizations for apartment buildings have increased by 116%, to 31,059 units during the first three quarters of this year from 14,388 units during the same period in 1975. Two-family unit authorizations have increased by 104% to 1,788 units from 878 units authorized during the first three quarters of 1975. One-family unit authorizations have increased by 32% to 37,011 from 28,143 in 1975, (Wurtzebach, 1976).

Nonresidential building construction has increased by 8% in the Texas Standard Metropolitan Statistical Areas during the first three quarters of 1976, based on the balue of building authorizations. Although decreases were noted in some SMSA's a 13% increased occurred in Houston. These authorizations should result in increases in employment as construction begins.

The influence of the increased level of petroleum exploration activity both within the state, and in other areas, was reflected in various sectors of the Texas economy.

"Employment in machinery manufacture (excluding electrical) was 8.0% higher in February 1975 than in February 1974, reflecting largely the increase of 17.5% in employment in oil field machinery manufacture. This is the result of the recent increase in oil exploration. Employment in the manufacture of instruments and related products, which also reflects the effects of oil exploration, increased 5.1% over the past year" (Stockton, 1975).

Employment within Texas in activities related to the oil and gas production and processing industries has also been affected during the past year as discussed by Stockton (1975).

"Crude oil production in February 1975, decreased 7.0% compared with February 1974, as the Texas fields have apparently reached their full capacity for the present. But higher prices for crude oil can be expected to continue; they will undoubtedly support exploration and will add substantially to the economy. Texas employment in oil and gas extraction in February 1975, showed an increase of 10.5% over the February 1974, figure, in spite of the fact that the total production of crude oil declined over the same period. The decline in gasoline consumption over the past year is reflected in the 15.1% decline of employment in refining. Some of the decline in refining has been offset by increased activity in chemicals, which are mainly petrochemicals. In spite of the decline in refining, oil and gas continue to be among the major supporting factors for the Texas economy.''

In reviewing the business situation in Texas during the first quarter of 1976, Stockton commented that residential construction during the first quarter of 1976 was above the comparable quarter of 1975, and manufacturing, as well as total nonfarm employment was higher in 1976 than during the comparable period of 1975. (Stockton, 1976).

b. Louisiana

Selected portions of the economic activity for Louisiana are presented in Table II-34. During 1970 approximately 40% of the manufacturing employment in southern Louisiana was in the durable goods industries and the remaining 60% was in the nondurable goods category.

Approximately 10% of the manufacturing employment in southern Louisiana during 1970 occurred in the metal industries, and almost 19% of the total manufacturing employment was in the category of chemicals and allied products.

Employment in retail trade in the city of New Orleans, and including a portion of the adjacent area of the State of Mississippi, amounted to approximately 76,000 persons during 1967, and an additional 31,000 were employed in wholesale trade in the same area.

During October 1976, the index of employment in manufacturing in Louisiana was 100.8, compared to 100.6 during the same period in January 1975. Employment in the category of construction increased from an index of 103.7 during October 1975 to 104.3 during 1976 (Federal Reserve Bank of Atlanta, 1976).

In the New Orleans SMSA including Orleans, Jefferson, St. Bernard, and St. Tammany Parishes, the civilian labor force during the month of December 1976 amounted to 427,400 persons, compared to 432,400 persons during December 1975. During December 1976, employment amounted to 396,900 persons, a decrease of 4,800 persons over the same month the previous year. However, comparing the unemployment for December 1976 with December 1975 reveals that unemployment also decreased. During December 1976, 30,500 persons were classified as unemployed, and decreased 200 from the 30,700 persons classified as unemployed during December 1975.

Dr. James A. Bobo reviewed the economy of the New Orleans area in an article published during July 1975. Dr. Bobo remarked on the change of pace in the local economy during 1973 and 1974. The growth of the labor force abated after September 1973, but grew at a greater rate than total employment through 1974. Unemployment tended to rise through 1974, and stood at 32,000 for the year. Two areas of high unemployment were manufacturing and construction, with residential construction described as being in a severe depression. Declines were also noted in agricultural employment and other nonagricultural employment, a category including the self-employed, domestics, and nonpaid family workers. Declines in the rate of growth were recorded in the trade and services, as well as in the finance, insurance and real estate sectors. Increases in employment were noted in the mining, government, and transportation-communications and public-utility sectors.

The Statistical Abstract of Louisiana (UNO, 1974) included wage data reproduced from Louisiana Department of Employment Security publications. During the year 1972 the average weekly wage in establishments covered by the state's employment security law amounted to $144.24. The average weekly wage paid in Crude Oil and Natural Gas (Mining) amounted to $209.86; in Chemical and Related Products, $240.04; in Oil Refining and Related Products, $239.63; and in Pipeline Transportation, $230.45.

2. Population and Employment

During September 1972, the U. S. Water Resources Council published the 1972 OBERS (an acronym for the Office of Business Economics and the Economic Research Service) projections of economic activity in the United States. These projections consist of historical and projected data incorporating population, employment and income and earnings information classified by state and by region. The 1972 projections utilized population projections published by the Census Bureau, and were based on the Series C fertility rates. Recently, the projections of economic activity in the various OBERS Economic Areas based on the Series E forecast a lower level of population in future years. The following projec-

Table II-34. Economic Activity for Louisiana

	1962	1972
Per capita personal income	$1,764	$ 3,543
Total personal income	$5,901	$13,179 (million)
Total cash farm income	$ 448	$ 882 (million)
Cash farm receipts from crops	$ 264	$ 507 (million)
Cash farm receipts from livestock and products	$ 164	$ 324 (million)
Petroleum production	477 ($2,300 million)	896 (mil. bbls.) $ 5,182 million)
Value of construction	$ 659	$ 2,036 (million)
Manufacturing employment	139	179 (thousand)
Construction employment	53	85 (thousand)

Source: Statistics on the Developing South, Federal Reserve Bank of Atlanta, May, 1972 and Supplements.

tions for BEA (Bureau of Economic Analysis) areas located adjacent to the Gulf of Mexico were obtained from the Series E projections.

In considering the coastal portions of the states bordering the Gulf of Mexico, during the period 1950 to 1970, the percentage increase in population and employment in all three regions was greater than the percentage increase in national population and employment. During the period 1970 to 1990, population and employment in the eastern and western Gulf of Mexico regions is expected to increase at greater percentage rates than the national percentage rates.

Table II-35 contains population, employment, and per capita income data, both historical and projected, for selected BEA areas included within the various regions adjacent to the Gulf of Mexico. The BEA economic regions included within the classification of western, central, and eastern Gulf of Mexico form only a portion of the various states bordering the Gulf of Mexico.

3. Agriculture

During the year 1950, 7,047,625 persons were employed in agriculture in the United States. By the year 1970, 2,813,971 persons were employed in agriculture, and the projected employment in the year 1990 amounted to 2,003,000 persons. The total earnings from agriculture amounted to 19,348,268 thousands of 1967 dollars during 1970, and are projected to amount to 22,562,000 thousands of 1967 dollars in 1990. These projections were contained in the 1972 OBERS projections (U. S. Water Resources Council, 1974) based on the Series E population projections developed by the Bureau of the Census. The OBERS projections do not reflect the current energy problem, changes in agricultural exports, or changes in conservation and environmental activities.

The total value of agricultural products within the states bordering the Gulf of Mexico is projected to increase during the period 1959 to 1980, according to the OBERS projections. The total land in farms was projected to decrease in both states during the same period of time. The decrease noted in the total land in farms is in accord with the projection for the entire United States.

During the period 1962 to 1972, the total workers on Texas farms decreased from 415,000 in 1962 to 275,000 in 1972. The total workers include both family workers and hired workers. The family workers decreased from 243,000 to 187,000, and the hired workers from 172,000 to 88,000 (A.H. Belo Co., 1973).

These changes in employment reflect post-war changes in Texas agriculture, also reflected in the increase in the average size of Texas farms and increases in the average value of land and buildings on farms and ranches.

The most notable change has been the mechanization of farming due to the increasing use of tractors, mechanical harvesters and other machinery in place of human and animal labor. The introduction and adoption of agricultural chemicals, improved plants and animals, irrigation and increased availability of off-the-farm services have also been significant factors in the change of Texas agriculture.

The patterns of decreasing farm employment were also evident in the other states bordering the Gulf of Mexico.

For instance farm employment in Louisiana decreased from 144,000 in 1962 to 73,000 in 1972.

4. The Petroleum Industry in the Gulf of Mexico Area

Some further discussion of the petroleum industry of the states adjacent to the Gulf of Mexico is appropriate since crude petroleum and natural gas production development as a result of exploration and production activity on the Outer Continental Shelf will probably be a source of raw material for initial processing within the coastal portions of these states.

The production of oil and gas may be classified as a primary industry; the further processing of oil and gas in refineries, natural gasoline plants and petrochemical plants may be considered as secondary industries, and the increased development of tertiary industries may be expected to develop as a result of the economic activity undertaken by the primary and secondary industries.

The coastal region of the states bordering the Gulf, including both onshore and offshore areas, have been productive of oil and gas for many years. The production of these hydrocarbons has led to the extensive development of a system of production, transportation, refining and other manufacturing facilities based on the availability of crude and refined petroleum products in the region.

Oil and gas resources include substances classified as crude oil, condensate, natural gas and

Table II-35. Population, Employment, and Per Capita Income, Historical and Projected 1950-2000 (1972-E, OBERS Projections, Bureau of Economic Analysis)

BEA	Economic Area	1950	1970	Percent Change 1950-1970	1980	1990	2000
137	Mobile, Alabama						
	Population	524,553	724,983	38.2%	768,400	840,000	870,900
	Per Capita Income	1,435	2,488	73.4%	3,500	4,600	6,300
	Total Employment	184,642	252,175	36.6%	296,900	328,500	355,000
138	New Orleans, La.						
	Population	1,535,505	2,149,598	40.0%	2,284,200	2,440,000	2,528,600
	Per Capita Income	1,641	2,849	73.6%	3,900	5,200	7,000
	Total Employment	530,342	717,945	35.4%	854,000	928,900	1,012,500
139	Lake Charles, La.						
	Population	534,509	750,632	40.4%	695,800	702,900	685,400
	Per Capita Income	1,256	2,463	96.1%	3,400	4,500	6,200
	Total Employment	162,484	245,083	50.8%	251,400	257,600	263,800
140	Beaumont-Port Arthur-Orange, Texas						
	Population	299,857	396,723	32.3%	432,800	484,900	520,100
	Per Capita Income	1,820	3,105	70.6%	4,200	5,500	7,400
	Total Employment	106,986	140,677	31.5%	168,800	192,300	215,800
141	Houston, Texas						
	Population	1,257,035	2,374,842	88.9%	2,832,400	3,362,700	3,780,400
	Per Capita Income	2,308	3,519	52.5%	4,700	6,100	8,000
	Total Employment	485,199	945,995	95.0%	1,244,700	1,474,400	1,701,900
142	San Antonio, Texas						
	Population	853,013	1,235,581	44.8%	1,245,900	1,352,000	1,417,200
	Per Capita Income	1,674	2,770	65.5%	3,800	5,000	6,800
	Total Employment	309,559	451,412	45.8%	503,500	550,300	598,300

(continued)

Table II-35(continued) Population, Employment, and Per Capita Income, Historical and Projected 1950-2000 (1972-E OBERS Projections, Bureau of Economic Analysis

BEA	Economic Area	1950	1970	Percent Change 1950-1970	1980	1990	2000
143	Corpus Christi, Texas						
	Population	407,011	518,920	27.5%	515,000	534,600	544,000
	Per Capita Income	1,525	2,651	73.8%	3,700	4,800	6,600
	Total Employment	132,095	176,319	33.5%	195,100	204,300	217,400
144	McAllen-Pharr-Edinburg, Texas						
	Population	323,177	356,998	10.5%	346,000	343,800	336,300
	Per Capita Income	1,111	1,884	69.6%	2,800	3,700	5,200
	Total Employment	99,547	101,880	2.3%	113,800	114,400	118,100

natural gas liquids. Crude oil is a mixture of hydrocarbons that exist as a liquid in the natural underground reservoir and continues to exist as a liquid on the surface at atmospheric pressure. Condensate is a substance that exists as a gas in the natural underground reservoir and exists as a liquid under atmospheric conditions. Natural gas plant liquids are hydrocarbons extracted from streams of natural gas processed at plants. The American Petroleum Institute and American Gas Association statistical data include as crude oil small amounts of hydrocarbons recovered from oil well gas that exist as gases in the reservoir but become liquid at atmospheric pressure. All other liquids, including condensate, are reported as natural gas liquids.

a. HISTORICAL DATA OF GULF OF MEXICO OCS OPERATIONS

In the Federal Power Commission News, December 10, 1976, a tabulation (Table II-36) of new well and completion activity on the Federal domain in the Gulf of Mexico was included in an article entitled "Gas Supply Indicators. Second Quarter, 1976."

Offshore gas well exploratory footage during the second quarter of 1976 was up 191.3% over the like period a year ago (35.9 compared to 12.3 thousand feet). Exploratory gas well footage was drilled off Texas and Louisiana.

Offshore developmental gas well footage during the second quarter amounted to 777 thousand feet, compared to 297 thousand feet for the second quarter of 1975, an increase of 161.8%

The percentage increases over the first 6 months of 1975 were much smaller, 21.2% for exploratory footage and 35.8% for developmental footage.

The number of acres held under active lease in the Gulf of Mexico has increased from 3.9 million acres in 1969 to 8.1 million acres as of December 29, 1976.

b. CRUDE PETROLEUM PRODUCTION

During the year 1975 approximately 30% of the total U.S. production of crude petroleum occurred in the states of Alabama, Louisiana, Mississippi, and Texas, and 28% of the total production was in the Gulf Coast areas of Texas and Louisiana alone. The quantities produced in the coastal area of Louisiana and Texas, as well as the total production from Alabama, and Mississippi, are shown in Table II-37.

A significant fact revealed by these statistics is a decline in the production of crude oil and condensate in this region. Production of crude petroleum in three of the four states in this area decreased between 1974 and 1975, reflecting the national trend. These decreases occurred in spite of an increase in the average value per barrel of oil.

Production figures obtained from the Petroleum Statement Monthly (Table II-38) indicate that the decline in offshore production in the Gulf of Mexico has been evident during the past few years.

c. NATURAL GAS

The Minerals Yearbook (U. S. Department of the Interior, 1973b), provides statistical detail concerning the source and use of natural gas.

Natural gas produced in Texas during 1971 was used to satisfy the demand for gas by individuals and organizations within Texas and in other areas of the United States. During the year 1971, natural gas was also imported from, and exported to, Mexico. Some volumes of natural gas produced in other states were transported into Texas during the year.

Approximately 90% of the natural gas withdrawn from Texas wells was marketed. The balance was used for repressuring and a small amount was vented to the atmosphere or flared. The marketed production of Texas natural gas, augmented by volumes obtained from other areas, was delivered to interstate pipelines for transmission to other areas, consumed in Texas or added to storage. Some amounts of gas were lost in transmission. Approximately 51% of the total Texas receipts of natural gas were consumed in Texas.

Some of this gas was used for lease and plant fuel and pipeline fuel, but approximately 72% was delivered to consumers, including residential establishments. The industrial uses of the natural gas included fuel for refining operations, feedstock for the chemical industry and as material for the manufacture of carbon black.

During the year 1973, the total marketed production of natural gas in the United States amounted to 22,648 billion cubic feet, an increase of 0.5% over the 1972 level. The marketed production in the states of Alabama, Florida, Louisiana, Mississippi, and Texas amounted to 16,901 billion cubic feet of this total, or approximately 75% of the total marketed production. (Table II-74)

Table II-36. Gulf of Mexico Drilling Activity

Year	Oil & Gas New Well Starts	Oil & Gas Well Completions	Zone Completions Producible Oil and Gas Zones		
			Oil	Gas	Total
1968	931	410	524	166	690
1969	826	363	448	125	573
1970	827	535	611	266	877
1971	806	379	357	240	597
1972	839	335	303	180	483
1973	816	418	302	288	590
1974	808	305	221	155	376
1975	863	390	218	277	495

Source: Federal Power Commission News, June 18, 1976.

Table II-37. Production, Producing Wells, Average Production Per Well

	1974	1975
Alabama		
Crude Petroleum Production 1/	13,323	13,477
No. Producing Oil Wells	582	608
Average Production Per Well 2/	62.5	62.1
Average Value Per Barrel	$8.54	$10.13
Louisiana (Gulf Coast)		
Crude Petroleum Production	698,488	613,502
No. Producing Oil Wells	12,858	12,535
Average Production Per Well	147.5	132.4
Average Value Per Barrel	$6.52	$7.10
Mississippi		
Crude Petroleum Production	50,779	46,614
No. Producing Oil Wells	2,254	2,237
Average Production Per Well	54.0	56.9
Average Value Per Barrel	$6.10	$6.66
Texas (Gulf Coast)		
Crude Petroleum Production	246,586	234,365
No. Producing Oil Wells	14,257	14,108
Average Production Per Well	47.5	45.3
Average Value Per Barrel	$7.41	$7.96
United States (Total)		
Crude Petroleum Production	3,202,585	3,056,779
No. Producing Oil Wells	497,631	500,333
Average Production Per Well	17.6	16.8
Average Value Per Barrel	$6.74	$7.56

1/ Thousands of barrels

2/ Average production per well per day (barrels)

Source: U. S. Department of the Interior (1976).

Table II-38.

Gulf of Mexico Region
Offshore Production of Crude Petroleum
(thousands of barrels)

	1972	1973	1974	1975
Gulf of Mexico				
1. Louisiana				
State	58,324	53,298	46,825	39,977
Federal	387,591	373,486	351,504	321,075
Total	445,915	426,784	398,329	361,052
2. Texas				
State	740	669	577	353
Federal	1,733	728	504	426
Total	2,473	1,397	1,081	779
Gulf of Mexico				
State	59,064	53,967	47,402	40,330
Federal	389,324	374,214	352,008	321,501
Total	448,388	428,181	399,410	361,831
Other Areas	159,334	150,817	144,226	139,389
Total U.S.	607,722	578,998	543,636	501,220

Source: Mineral Industry Surveys, Bureau of Mines

Net deliveries of natural gas to interstate pipelines during 1973 amounted to approximately 5,906 billion cubic feet from Louisiana and 3,391 billion cubic feet from Texas. Consumption of natural gas in the five state region amounted to approximately 8,206 billion cubic feet during 1973, approximately 36% of the total U. S. consumption during the year (USDI, 1973e).

The number of producing gas and condensate wells located in the five state area increased from 33,906 to 34,621 between December 1972 and 1973.

The FPC News (May 10, 1973), in a review of aspects of the natural gas supply in the United States, remarked on the recovery of gas well drilling activity that began in 1972 and continued during 1973 until capacity bottlenecks occurred toward the end of the year. The review continued an analysis of the current supply situation.

> "In contrast, the shortage of gas supply for ultimate consumers became more acute during 1973. For the past three years both marketed production of natural gas and producer sales to interstate pipelines have fluctuated within a very narrow range. Between 1972 and 1973 marketed production declined by 0.3% and producer sales (FPC Form 11 reports) declined 2.9%. In the previous year there were increases of 0.2% in marketed production and 1.3% in producer sales. It is thus apparent that the new reserves that have become available as a result of increased gas well drilling have not been sufficient to prevent a further worsening of the national gas shortage. During the past year or two, some pipelines were unable to acquire enough new reserves to offset the declining production from old wells, let alone meet the obvious need of all pipelines for more gas to serve the increased demand created by growth in the economy."

On June 18, 1976, the FPC released a staff report which indicated that estimated natural gas curtailments for major interstate natural gas pipeline companies for the 12-month period April 1976 through March 1977 will be more than 3.6 trillion cubic feet, compared to an actual curtailment of 2.8 trillion cubic feet for the year April 1975 through March 1976. This indicates that pipeline companies project that they will be able to deliver only 75% of the gas they are committed to deliver.

d. Employment in Offshore Petroleum Activities

The Department of Commerce, 1972 Census of Mineral Industries, provides data on mining operations concerned with the extraction of solids, liquids, and gases.

For oil and gas field operation and contract services, reports were required for units somewhat different from the "establishment" reporting unit used for other types of mining. Every concern which operated oil and gas wells or performed oil and gas field services for others during any part of calendar year 1972 was required to submit a separate report for each state, or offshore area adjacent to a state.

Industries were classified in accord with the definitions established in the 1972 Standard Industrial Classification Manual. This system was developed over a period of years by experts from government and private industry under the guidance of the Office of Management and Budget.

Industry 131, Crude Petroleum and Natural Gas, represents establishments primarily engaged in operating oil and gas properties. Such activities include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operation of separators, emulsion breakers, desalting equipment; and all other activities incident to making oil and gas marketable up to the point of shipment from the producing property. The data published for this industry include figures for administrative offices, warehouses, storage facilities, and other auxiliary units which service mining industries. For the crude petroleum and natural gas industries, details were obtained on the type of wells drilled and operated and reports were classified on the basis of whether or not they drilled wells. No drilling data or wells-operated data were obtained or estimated for companies with less than five paid employees. While these small companies account for a small percentage of value added in the oil and gas industry, they do engage in significant drilling activity and they also operate a large number of wells.

SIC Industry Group 138, Oil and Gas Field Services, includes three principal industries. Industry 1381, Drilling Oil and Gas Wells, represents establishments primarily engaged in drilling wells for oil or gas for others on a contract, fee or other basis. This industry includes contractors

Table II-39.

Natural Gas Production and Consumption

(Figures in Million Cubic Feet)

	1973	1974
1) Gross Withdrawals		
Alabama	13,161	29,357
Florida	33,857	38,137
Louisiana	8,491,194	7,919,810
Mississippi	117,761	98,995
Texas	9,289,945	8,859,044
Total	17,945,918	16,945,343
2) Marketed Production		
Alabama	11,271	27,865
Florida	33,857	38,137
Louisiana	8,242,423	7,753,631
Mississippi	99,706	78,787
Texas	8,513,850	8,170,798
Total	16,901,107	16,069,218
3) Consumption		
Alabama	272,267	275,262
Florida	314,384	292,920
Louisiana	2,216,692	2,202,693
Mississippi	314,870	276,878
Texas	5,087,521	9,912,481
Total	8,205,734	12,960,234
4) Net Deliveries to Interstate Pipelines		
Alabama	-259,033	-254,294
Florida	-282,070	-255,493
Louisiana	+5,905,857	+5,526,285
Mississippi	-215,225	-205,421
Texas	+3,390,531	+3,229,637
Total	+8,540,060	+8,040,714

Source: USDI, Bureau of Mines

that specialize in spudding in, drilling in, redrilling, and directional drilling. Industry 1382, Oil and Gas Exploration Services, represents establishments primarily engaged in geophysical, geological, and other exploration work on a contract, fee, or other basis.

Industry 1389, Oil and Gas Field Services, (not elsewhere classified) represents establishments primarily engaged in performing for others on a contract, fee, or other basis, such oil and gas field services as excavating, well cementing, well treating, and running, cutting, and pulling casing, tubes and rods.

SIC Industry Group 132, Natural Gas Liquids, represents establishments primarily engaged in producing liquid hydrocarbons from oil and gas field gases. Establishments recovering liquified petroleum gases incident to petroleum refining or to the manufacturing of chemicals are classified in Major Groups 28 or 29, are therefore not included within this group.

Data published in the applicable volumes of the 1972 Census of Mineral Industries reveal the historical changes in establishments, employees and payrolls in these industrial categories in the United States, Table II-40.

Table II-40 also provides a summary of the employment within the oil and gas exploration and production related industries during the year 1972.

During the year 1972, U.S. total number of employees amounted to 240,500 persons. The total number of employees classified as working on offshore activities was 14,400 persons, approximately 6% of the total national employment in these industry groups. The total employment associated with the Louisiana offshore amounted to 11,900 persons, approximately 5% of the total national employment and 83% of the total national offshore employment (Table II-41).

The number of employees employed by natural gas producing units is shown in Table II-42.

5. The Petrochemical Industry in the Coastal Zone

On January 1, 1976, the crude oil capacity of the operating petroleum refineries in the United States amounted to 14,867,529 barrels per calendar day. An additional 247,100 BCD of refining capacity was located in Puerto Rico and the combined crude oil capacity in these operating refineries amounted to 15,114,629 barrels per calendar day. The total operating refinery capacity in the refining districts along the coast of the Gulf of Mexico amounted to 5,345,450 BCD or approximately 35% of the total U.S. capacity (Table II-43).

Additional crude oil refining capacity amounting to 620,900 barrels per day was under construction in the coastal area of the Gulf of Mexico. This capacity amounts to approximately 53% of the capacity under construction in the U.S.

Comments concerning the refining and petrochemical industries in the various states, pertaining to the existing industrial development follow, and tabulated data are included in Tables II-43, II-44 and II-45.

a. PETROLEUM REFINING INDUSTRY OF TEXAS

The Texas Gulf coast refining district is the larg- est domestic refining district, measured in crude oil throughput capacity, and accounted for approximately 23% of the total operating crude oil throughput capacity of the United States (including Puerto Rico) (USDI, GS, 1973). The Texas Gulf coast refining capacity has ranged from 22% to 24% of the total U.S. refining capacity since 1962.

During the period 1962 to 1973, the daily crude oil capacity in the Texas Gulf coast district increased by 846,400 BCD, an increase of approximately 39% over the 1962 operating capacity. The raw material received at refineries in the Texas Gulf coast refining district includes oil from domestic and foreign sources, natural gas liquids and other hydrocarbons. The products produced by refineries include gasoline and other fuels, lubricating oils, wax, coke, asphalt and feedstocks for petrochemical plants. Refineries in Texas receive crude oil from other states for processing, and some of the crude oil produced in Texas is shipped to other states for refining.

During the year 1974, a total of 1,189 million barrels were received at refineries in Texas. Approximately 961 million barrels were obtained for sources within the U.S., and an additional 227 million barrels were obtained from foreign sources. This level of imports is approximately equal to 622 thousand barrels per day (USDI, 1974).

Since approximately 87% of the operating crude oil refining capacity of Texas is located in the Texas Gulf coast district, the following statement referring to the total Texas refining industry is applicable to the Gulf coast area. The data was ob-

Total United States

Table II-40. Exploration and Production Employees - 1972

Number of Employees (thousands)

Year	SIC 1311	SIC 1321	SIC 138	Total
1954	172.5	17.3	125.9	315.7
1958	180.1	16.5	116.3	312.9
1963	145.2	13.9	112.4	271.5
1967	126.4	12.4	106.4	245.2
1972	116.6	10.7	113.2	240.5

Number of Establishments

1954	11,508	562	5,515	17,585
1958	12,010	593	5,915	18,518
1963	14,378	652	6,212	21,242
1967	8,796	684	6,878	16,358
1972	7,605	680	6,209	14,494

Payroll (million of dollars)

1954	835.7	85.1	541.6	1,462.4
1958	1,043.1	96.3	561.3	1,700.7
1963	1,016.4	96.6	631.7	1,744.7
1967	1,049.1	99.5	706.5	1,855.1
1972	1,376.0	116.8	1,032.9	2,525.7

Source: Census of Mineral Industries (1972)
Bureau of the Census

Table II-41. Employees on Offshore Operations

All Employees (thousands) 1972

Industry	Total U.S.	Total Offshore	West South Central Region	Total Louisiana	Louisiana Offshore	Total Texas	Texas Offshore	Other Offshore California	Other Offshore Alaska
131 - 1311	116.6	5.3	77.7	20.0	4.0	46.7	0.3	0.7	0.3
132 - 1321	10.7	N.D.	8.1	1.7	N.D.	5.1	N.D.	N.D.	N.D.
138 - 1381	45.2	5.1	29.3	11.4	4.6	13.7	0.5	N.D.	N.D.
138 - 1382	9.8	0.2	5.7	0.8	0.1	4.2	N.D.	N.D.	N.D.
138 - 1389	58.2	3.8	40.1	12.3	3.2	18.7	N.D.	N.D.	N.D.
Total	240.5	14.4	160.9	46.2	11.9	88.4	0.8	0.7	0.3

Production, Development and Exploration Workers (thousands) 1972

Industry	Total U.S.	Total Offshore	West South Central Region	Total Louisiana	Louisiana Offshore	Total Texas	Texas Offshore	Other Offshore California	Other Offshore Alaska
131 - 1311	51.9	3.7	30.8	9.5	3.0	16.1	0.2	0.4	0.1
132 - 1321	8.9	N.D.	6.7	1.4	N.D.	4.5	N.D.	N.D.	N.D.
138 - 1381	40.1	4.5	25.6	10.0	4.0	11.9	0.5	N.D.	N.D.
138 - 1382	7.8	0.1	4.3	0.7	0.1	3.1	N.D.	N.D.	N.D.
138 - 1389	45.5	3.2	31.0	10.0	2.7	15.1	N.D.	N.D.	N.D.
Total	154.2	11.5	98.4	31.6	9.8	50.7	0.7	0.4	0.1

Note: N.D. means No Data.
Industry 1311 - Primarily engaged in operating oil and gas field properties.
Industry 1321 - Primarily engaged in producing liquid hydrocarbons from oil and gas field gases.
Industry 1381 - Primarily engaged in drilling oil or gas wells for others on a contract, fee, or similar basis
Industry 1382 - Primarily engaged in performing geophysical, geological and other exploration services on contract or fee.
Industry 1389 - Primarily engaged in performing miscellaneous oil and gas field services.

Source: U.S. Dept. of Commerce, Mineral Industry Surveys

Table II-42

Number of Natural Gas Liquids Producing
Units and Employment - 1972

State	Number of Reporting Units	Number of Employees
Louisiana	104	1,700
Texas	302	5,100
Totals	406	6,800
Total U. S.	680	10,700

State	Natural Gas Processed (Billion cubic feet)
Louisiana	6,650.0
Texas	7,178.6
Total	13,828.6

Source: 1972 Census of Mineral Industries
Natural Gas Liquids (SIC 132)
U. S. Dept. of Commerce

Table II-43. Operating Petroleum Refineries (January 1, 1976)
Gulf of Mexico Region
Bureau of Mines Refining Districts

Operator	Location	Crude Capacity B/D 1/
Texas Gulf Coast Refining District		
American Petrofina	Port Arthur	84,000
Amoco Oil	Texas City	333,000
Atlantic Richfield	Houston	213,000
Champlin Refining	Corpus Christi	65,200
Charter International	Houston	70,000
Coastal States Petrochemical	Corpus Christi	185,000
Crown Central Petroleum	Pasadena	100,000
Eddy Refining	Houston	3,250
Exxon	Baytown	390,000
Gulf	Port Arthur	312,100
Marathon	Texas City	64,000
Mobil	Beaumont	335,000
Monsanto	Alvin	8,500
Phillips	Sweeny	85,000
Quintana Howell (Joint Venture)	Corpus Christi	30,000
Saber Petroleum	Corpus Christi	10,000
Shell	Deer Park	294,000
South Hampton	Silsbee	15,100
Southwestern Refining	Corpus Christi	124,000
Sun	Corpus Christi	57,000
Texaco	Port Arthur	309,000
Texaco	Port Neches	47,000
Texas City Refining	Texas City	74,500
Union Oil of California	Nederland	120,000
Union Texas Petroleum	Winnie	9,400
Sub Total (Texas Gulf Coast)		3,338,050
Louisiana Gulf Coast Refining District		
Alabama		
Marion Corp.	Theodore	19,200
Louisiana Land & Exploration	Mobile	30,000
Sub Total (Alabama)		49,200
Louisiana		
Canal Refining	Church Point	4,000
Cities Service	Lake Charles	268,000
Continental Oil	Egan	15,000
Continental Oil	Westlake	83,000
Evangeline Refining	Jennings	5,000

(continued)

1/ B/D = barrels per day

Table II-43(continued). Operating Petroleum Refineries (January 1, 1976)
Gulf of Mexico Region
Bureau of Mines Refining Districts

Operator	Location	Crude Capacity B/D 1/
Louisiana (continued)		
Exxon	Baton Rouge	455,000
Good Hope Refineries	Good Hope	45,000
Gulf Oil	Belle Chasse	180,400
Gulf Oil	Venice	28,700
La Jet	St. James	11,000
Murphy Oil	Meraux	78,000
Placid	Port Allen	36,000
Shell	Norco	240,000
Tenneco	Chalmette	89,100
Texaco	Convent	140,000
Sub Total Louisiana		1,678,200
Mississippi		
Standard Oil Company (Kentucky)	Pascagoula	280,000
Sub Total (Louisiana Gulf Coast)		2,077,400
East Coast Refining District		
Florida		
Seminole Asphalt Refining	St. Marks	6,000
Total Gulf of Mexico		5,351,450 B/D 1/

1/ B/D = barrels per day

Source: Bureau of Mines, Annual Refining Survey

Table II-44. Additional Crude Oil Refining Capacity Under Construction on January 1, 1976

Operator	Location	Additional Crude Capacity B/D [1/]
Texas Gulf Coast Refining District		
American Petrofina	Port Arthur	34,000
Champlin Petroleum	Corpus Christi	55,000
Exxon Co.	Baytown	250,000
Saber Petroleum	Corpus Christi	5,000
Sub Total (Texas Gulf Coast)		344,000
Louisiana Gulf Coast Refining District		
Alabama		
Marion Corp.	Theodore	1,900
Louisiana Gulf Coast		
ECOL Ltd.	Garyville	200,000
Exxon	Baton Rouge	10,000
		210,000
Sub Total (Louisiana Gulf Coast District)		211,900
Total Gulf of Mexico		555,900

1/ B/D = barrels per day

Source: Bureau of Mines, Annual Refining Survey

Table II-45. Refinery Receipts of Crude Oil (1974)
(Figures are in thousands of barrels)

	Alabama	Louisiana	Mississippi	Texas	Total
Refinery Receipts					
Intrastate sources	1,129	376,881	15,678	803,030	1,196,718
Interstate sources	10,606	104,444	62,972	158,596	336,618
Foreign sources	275	55,314	7,345	227,065	289,999
Total	12,010	536,639	85,995	1,188,691	1,823,335
Disposition of Crude					
Input to refinery	11,876	535,220	85,430	1,188,124	1,820,650
Refinery fuel	125	121	113	240	599
Change in stocks	+ 9	+1,298	+ 452	+ 327	+1,086
Total	12,010	536,639	85,995	1,188,691	1,823,335

Source: Bureau of Mines, Petroleum Statement Monthly tained from a paper prepared by the Office of Information Services, State of Texas, on January 2, 1974.

The importance of the petroleum refining industry to the Texas economy is partially demonstrated by the dollar value of sales, employment, and household income generated directly by its operations. In 1972, the industry's total sales f.o.b. the refinery was $7.7 billion. The industry employed approximately 33,700 workers and paid an estimated $481 million to Texas households in wages, salaries and other payments. In addition, the petroleum refining industry provided inputs for production processes in many other industries, most notably the petrochemical industry. It is estimated that approximately 7% or $577 million of the Texas refineries' production was used by the petrochemical industry in 1972. The total production of the petrochemical industry in Texas in 1972 was estimated at $5.8 billion f.o.b. the plant.

b. Petrochemical industry

The importance of the chemical industry to Texas was recently evaluated by Ryan (1973). Chemical production is Texas' top-ranking industry as measured by value added by manufacture (the difference between the cost of raw materials and the value of products). In 1973, more than 61,000 workers were employed in chemical plants; the output value in 1970 totalled $4.8 billion. The most important produce group is industrial organic chemicals, the basic materials from which synthetic fibers and plastics, rubber, lubricants and hundreds of other products are made.

In addition to the onshore economic effects due to the refining of crude oil, additional economic activity would result from the further processing of fractions of the crude oil, natural gas and petroleum liquids within the petrochemical industry of Texas. The following is from Whitehorn (1973).

The petrochemical industry in Texas is large, complex and integrated. It exerts a strong influence on industrial activities and provides a tremendous economic impact upon the state's economy. Petrochemicals were defined by Whitehorn for his report as those chemicals derived from petroleum and/or natural gas, but excluding all fuel and energy products such as gasoline, fuel oil, natural gas for fuel, kerosene, lubricating oils, as well as asphalt, wax and coke.

A 1972 survey, cited to Whitehorn, identified 82 firms operating 139 petrochemical manufacturing plants in Texas. While there were plants located in every part of the state, more than 67% by number and 88% by capacity were located in the coastal zone.

By volume, the Texas Gulf coast has the greatest U.S. concentration of chemical plants producing more than 40% of every basic petrochemical, 80% of the synthetic rubber, and 60% of the nation's sulfur. By conservative estimates, the total production of petrochemicals in Texas in 1971 was between 75 and 85 billion pounds. Ethylene is produced in greatest quantity, with propylene and benzene next. Texas' petrochemical industry began during the 1920's. The 1950's and early 1960's marked the industry's greatest growth, ranging annually from 10% to nearly 20%. Although it dipped in the late 1960's, the growth rate for the next few years appears to be good with estimates between 7% and 8% annually (Whitehorn, 1973).

Late in the year 1972, a survey revealed that 622 petrochemical plants were operating within the U.S. Of this total number of plants, approximately 22% were located in Texas. More than two-thirds of the plants representing almost 90% of the producing capacity were located in the coastal zone of Texas. During the period 1950-59, twenty-one plants commenced operations; during the period 1960-69, seventeen plants went on stream.

The most important reason cited for growth of the petrochemical industry in Texas is "nearness to raw materials". Other factors influencing the development of this industry have included the availability of an existing facility; the availability of transportation, labor and land; and nearness to markets.

c. Petroleum-related industries in Louisiana

The following description of some of the important industries in the Louisiana coastal zone was published in the Louisiana Advisory Commission Coastal Marine Resources (1973a). The following description of the more important industries in the coastal zone parishes by the Louisiana Department of Commerce and Industry was presented in a report to the Commission in February, 1972.

Industry in the coastal region is dominated by petroleum refining, petrochemical production, ship and boat building, food processing and primary metals. Apparel making, metal fabrication, and pulp and papermaking are also important industries. Petroleum refining and petrochemicals are by far the largest. More than $5 billion has been invested in these industries in the coastal region since World War II and most of the 32,000 plus workers employed in these industries work in the coastal parishes. There are approximately one hundred major petroleum and petrochemical plants in Louisiana making the state one of the principal producers in the U.S. A number of the facilities are among the largest of their kind in the world. Over the last ten years Louisiana has attracted about 10% of all new investment in chemical and petroleum refining expenditures in this country.

Ship and boat building continue to be a mainstay in the state's industrial economy. A shipyard is the single largest employer in Louisiana, with a work force ranging upward to ten thousand at times. The Avondale yards and other smaller yards specialize in supplying the needs of the offshore oil and gas industry with drilling platforms, tugs, barges, crewboats and other specialized vessels that are constructed in Louisiana. Boats for commercial fishing and pleasure use are built in small yards scattered across the coastal region.

Specific areas within Louisiana with important concentrations of refineries and petrochemical plants include Baton Rouge, New Orleans and Lake Charles. The Lower Mississippi Region Comprehensive Study includes descriptions and projections for significant economic and industrial factors. Water Resource Planning Area 8 includes ten Louisiana parishes and Amite County, Mississippi, and includes the Baton Rouge area. An economic description of this area emphasizes the importance of the Baton Rouge industrial development.

Baton Rouge, capital of Louisiana, is a major center of petroleum and chemical industries. It is situated on the Mississippi River two hundred miles from the Gulf of Mexico at the head of navigation for ocean-going vessels. The total value of industrial investment along the banks of the Mississippi River in WRPA 8 since 1946 has been $1.9 billion ($0.6 billion between 1946 and 1960, and $1.3 billion between 1961 and 1971). In 1967, East Baton Rouge Parish accounted for 81% of the area's $564.1 million value added by manufacturing. Petroleum refineries, the industrial base of the city, are supplied by nearby oil fields in south Louisiana. Many plants in the city either supply refinery needs, further process refinery products, or are engaged in related work.

Water Resource Planning Area 9 includes a fourteen parish area extending from the border of Texas to the basin of the Atchafalaya River, bordering the Gulf of Mexico. WRPA 9 is rich in oil, natural gas, salt, sulfur, sand and gravel, and clays. The development of oil and natural gas resources has contributed to the rapid strides made in the raising of living standards and industrial growth. Oil and gas fields are located throughout the area as well as offshore in the Gulf of Mexico. Salt deposits are located on the eastern and western borders, and sulfur is mined in Calcasieu Parish.

A combination of varied resources, water access, geographical location, and road and rail connections has made WRPA 9 an attractive location for industrial firms. The extent and quality of these resources are attested to by some of the Nation's major chemical producers having developed a multi-million-dollar petrochemical complex around Lake Charles. Natural resources have also been of great importance to Lafayette, Louisiana, as it has become the area headquarters and service center for the oil and gas industry. Industrial growth has also been enhanced by the existence of the deepwater port of Lake Charles.

Water Resource Planning Area 10 includes the New Orleans Standard Metropolitan Statistical Area (Jefferson, Orleans, St. Bernard, and St. Tammany Parishes.) Due to the presence of varied natural resources and its location on crossroads of internal and foreign commerce, WRPA 10 has experienced remarkable industrial development. A vast complex of petrochemical plants has been developed in recent years along the Mississippi River. Other industries have grown up around such native resources as sulfur, salt and sugar, and imported products such as bauxite, gypsum and coffee have also contributed to industrial development.

6. Transportation of Crude Oil and Products

During 1974, refineries in Texas and Louisiana received crude oil from producing wells in the same state as the refinery location, from producing wells in other states and imported crude oil from foreign nations (Table II-46).

Table II-46. Transportation of Crude Oil in 1974

Area	Pipelines	Tank Cars & Trucks	Tankers & Barges
Alabama			
Domestic crude	4,285 1/	124	6,872
Foreign crude	---	---	272
Louisiana			
Domestic crude	415,079	5,084	96,370
Foreign crude	---	---	16,510
Mississippi			
Domestic crude	91,380	1,823	---
Foreign crude	---	---	---
Texas			
Domestic crude	920,773	9,619	115,054
Foreign crude	---	---	128,872
Totals	1,413,517	16,650	363.950

1/ All figures shown are in thousands of barrels

Source: USDI, Bureau of Mines.

These figures show the relative importance of pipeline transportation in providing means for the delivery of crude petroleum to refineries in the four state area.

According to figures published by the Bureau of Mines the total mileage of petroleum pipelines in place in Louisiana amounted to 8,791 miles on January 1, 1974 compared to 7,956 miles on January 1, 1971.

In Texas, there were 65,472 miles in place in 1974 compared to 65,259 miles in place on January 1, 1971. The apparent small increase in total mileage obscures the amount of pipeline installation taking place. During the three year period, 4,652 miles of pipe were taken up, and 4,865 miles of new and second-hand pipe were laid.

Petroleum pipelines are classified as gathering lines, crude oil trunklines and products pipelines.

Mileage (January 1, 1974)

	Gathering	Crude oil	Products
Louisiana	2,247	3,740	2,804
Texas	24,794	27,490	13,188

Table II-47 presents the quantities of crude oil and products that were moved by tanker and barge from the Gulf coast to other areas of the U.S. during the period January to May of the years 1973 and 1974.

Table II-47. Water Transport of Crude Oil and Products

	January to May 1974	1973
Gulf Coast to East Coast		
Crude oil	30,513 [1/]	29,620
Unfinished oils	9,301	6,998
Products	155,515	183,078
Totals	195,329	219,696
Gulf Coast to P.A.D. District II		
Crude oil	4,871	4,365
Unfinished	8	18
Products	26,557	27,538
Totals	31,436	31,921
Gulf Coast to West Coast		
Crude oil	564	---
Unfinished oils	---	113
Products	5,371	638
Totals	5,935	751

1/ All figures are in thousands of barrels

Source: USDI, Bureau of Mines, 1974

J. Future Environment Without This Proposal

The addition of any oil and gas produced as a result of this proposed sale to the quantities of oil and gas currently being produced on the Outer Continental Shelf in the Gulf of Mexico can be expected to continue the use of facilities installed for the transportation and processing of oil and gas reserves developed from previous state and federal offshore lease sales.

Production developed in onshore areas prior to, concurrent with, and subsequent to production developed in the offshore areas also requires production, transportation and processing facilities. In the event that this proposed sale was not held, it is considered probable that the skilled and unskilled labor, specialized equipment and other facilities that would be employed in the development of leases awarded as a result of proposed Sale 45 would be employed in the specialized activity of exploring for, producing, processing and transporting oil and gas in an alternate area.

The resultant economic and environmental impact for these activities in other areas cannot be known at this time, as it would be necessary to delineate these areas in a precise fashion in order to estimate the extent of these impacts. It is possible that the resources would be employed in the onshore areas of the states adjacent to the OCS areas; in which case, the economic impact would be similar to the impact anticipated to result from this proposed sale.

Given the extensive development of industries supporting the offshore production of oil and gas, and the extensive development of industries related to the processing of oil and gas, additional supplies of oil and gas from any source in the Gulf of Mexico area are likely to be processed within existing facilities in the area.

It is probable that industry interest in the OCS indicates that larger quantities of oil and gas may be obtained for a given investment dollar. If this speculation is valid, it suggests that Outer Continental Shelf production is efficient in the economic sense, in that a large return can be anticipated from a small expenditure of scarce resources.

A further observation governing the continued operation of the refining industry, and industries utilizing the products of refineries may be in order. It is probable that existing refineries within the Gulf of Mexico coastal area will continue to operate as long as demand for the products continue. In the event that a sufficient supply of feed stock is not available, imported crude oils will be utilized. According to the March 1976 issue of the Monthly Energy Review, published by the Federal Energy Administration, imports of crude oil amounted to approximately 4.5 million barrels per day, compared to domestic production of an estimated 8.2 million barrels per day during December 1974.

The environmental effects of additional onshore production, and/or additional crude oil imports to the existing refining centers, must be considered in determining the status of the future environment of the Gulf of Mexico region in the event that this proposed lease sale is not implemented.

Section III

Environmental Impacts of the Proposed Action

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BLM
NEW ORLEANS OCS

A. Basic Assumptions Utilized in the Analysis of Environmental Impacts

Oil and gas operations on the OCS may affect marine and coastal ecosystems in a variety of ways. These effects can be conceptualized through an understanding of the operations, support equipment, and products utilized and produced in obtaining the level of hydrocarbon resources projected for this proposed sale. Based on assumptions provided by the U.S. Geological Survey (Section I.B.1) the areas offered for lease will contain approximately 100 to 200 million barrels of oil and 1.5 to 2.2 trillion cubic feet of natural gas. About 50 to 150 exploration wells and 100 to 250 development wells drilled to an average depth of 8,000-12,000 feet are projected in obtaining the resources estimated for the proposed leasing area. Additionally, there will be a need for 20 to 35 drilling and production platforms, up to 282 km of pipeline, 0 to 2 onshore oil terminals, and 0 to 2 gas processing terminals. Peak daily production may reach 15,000 to 30,000 barrels of oil and 300 to 500 million cubic feet of natural gas.

The activities involved in achieving peak production include exploration, development, production, and transportation of products. Twenty to 30 years might elapse between exploration and termination should payable quantities in a particular lease tract be discovered. Within the lease tract itself the greatest stress to the environment would normally occur during the exploration and development stages when drilling is taking place.

During the life of a lease tract the following potential causes pose the greatest threat to the marine and related coastal environment: operations, cuttings and drilling muds, formation waters, platforms, pipelines, oil spills and onshore development.

1. Operations

All activities relating to oil and gas operations involve people, equipment and supplies which must be transported from shore to tract and tract to shore. The drilling phases (exploration and development) require more people, equipment and supplies; however, the movement from shore to tract and tract to shore remains relatively constant throughout the life of an active lease. Approximately one boat (crew or supply) and one helicopter would make the round trip between shore and lease tract or pipeline lay barge on the average every one to two days in developing leases or pipelines.

When a lease is determined to be commercially productive a platform may be designed and fabricated onshore for establishment on the lease site where development drilling (average 10-20 wells per platform) and production will take place. Currently there are over 2,000 structures in the Gulf of Mexico OCS as a result of oil and gas activity and the USGS data for the past three years indicate an average of 40 structures are removed annually from the Gulf of Mexico.

2. Cuttings and Drilling Fluids ("Muds")

Cuttings and drilling fluids are encountered during exploration and development phases when well drilling is in process. Cuttings are solid particles of rock brought up by the drill bit. These particles are disposed of overboard where they settle to the bottom. The other effluent resulting from drilling operations are the muds which are used to control pressures, lubricate the drill bit, and remove cuttings. Some of the mud remains attached to the cuttings when they are discharged. As the cuttings cascade down through the water column, the mud is washed free and creates a turbid plume trailing with the prevailing surface current. A complete discussion of the use and disposal of drilling fluids may be found in Monaghan, et al. (1976), Otteman (1976), and the FEIS for Sale No. 47. What follows is taken from those discussions.

Quantities of drilling fluids are discharged into the surrounding water during normal operations, some with the cuttings and a great deal more when mud mixtures must be changed, and at the end of operations when all the muds remaining in the system are dumped. While the amounts of muds discharged can be quite high, it should be noted that the amount of drilling mud used and discharged varies considerably from well to well. Estimates prepared by Imperial Oil Ltd. for the Canadian government show the variability in mud discharges. The estimates were made for two drill sites in Mackenzie Bay. In drilling a 9,000-foot well, 1.45 million pounds of mud components were used and an estimated 0.76 million pounds, 0.46 of which were barites, were discharged. The total discharge amounted to approximately 5,000 barrels of mud. The large amount of barite used in this well indicates that it may have been abnormally pressured. At another Mackenzie site, 369,000 pounds of mud components were used and 297,000 pounds were discharged while drilling a well to 10,500 feet. The 297,000 pounds included 114,000 pounds of barite. Therefore, estimates of amounts to be used in the future, based on previous experience, must be used with caution. Research on the amounts and fates of drilling muds and cuttings is continuing and will ultimately resolve the problem of the environmental effects of these discharges.

Using estimates provided for this proposal by USGS (Section I, Table I-1), a possible 150 exploration wells and 300 development wells would yield between 306,900 and 452,500 tons of drill cuttings and between 1,530,000 and 3,150,000 barrels of drilling fluids to the Gulf of Mexico. Observations in the Gulf of Mexico indicate that these drill cuttings form low mounds on the seafloor with a maximum relief of approximately 20 cm. These may be worked into the surrounding sediment by bioturbation or recolonized by organisms and do not seem to present a long term adverse impact on the area.

In certain cases, biocides such as pentachlorophenol or formaldehyde are added to the drilling fluids to prevent the growth of bacteria which would cause corrosion of the well casing. These agents can be introduced into the environment by accident or intentional discharge. When introduced into the marine environment, some toxic effects to marine organisms, particularly plankton, will occur in localized areas around the discharge. These biocides are used if the installation is to be temporarily abandoned and the fluids remain in sites around the well casing.

The U.S. Environmental Protection Agency is currently conducting research to determine the relative toxicities of these biocides and the BLM is planning to research the amounts and types currently used in the Gulf of Mexico. Tentative results, while certainly not conclusive, indicate that any toxicity that may be present in the muds is rapidly dissipated and does not seem to present any significant adverse impact on the biota.

3. Produced Water (Formation Water)

Produced water or liquid associated with the extracted oil and gas must be removed and disposed of. Produced water is relict sea water but with anomalous ion ratios. The ranges of constituents found in produced formation waters offshore Louisiana are listed in Table III-1. Using the estimated ratio of produced water per barrel of oil which is provided in Section I, Table I-1, between 36 million and 72 million barrels of formation water could be introduced into the Gulf over a 20-year period.

The following discussion of produced water is taken largely from Koons, et al. (1975).

Produced waters generally contain appreciable concentrations of dissolved inorganic salts in which the principal cations are sodium, magnesium, and calcium. The principal anions are chloride, sulfate, carbonate and bicarbonate. The concentrations of total dissolved constituents can vary over a wide range such as from a few milligrams per liter to as much as 350,000 mg/liter. Collins (1974, 1975) reviewed the composition of many oil field waters and found that the majority contained high chloride concentrations. Hydrocarbons and some organic compounds may be present in produced waters at part per million levels. Dissolved oxygen may be present at low concentration in produced waters.

Typical sodium concentrations range from 23,000 to 57,000 mg per liter. Typical calcium concentrations are between 2,500 to 25,800 mg per liter and those for magnesium are from 100 to 5,000 mg per liter. There are occasional waters in which values either much higher or lower than the averages are observed.

It is important to note that the metal ions present in highest concentrations are those which are common either to seawater or many terrestrial deposits and are not considered hazardous. Those metals generally considered as toxic are present at very low concentrations, often below the level of detection of even the sensitive methods used. The metals which would be of greatest concern in the environment are those which are toxic in concentrations of parts per million or less. To consider any possible hazards in discharging produced waters containing toxic metals into the marine environment, it is necessary to consider the following three factors:

(1) Concentration of trace metals in produced waters

(2) Concentration of trace metals in normal seawater

(3) Toxicity levels of toxic metals. With the exception of Cu, Cr, Mn, and Sr, the concentration of trace metals in produced waters is not much different from that found normally in seawater.

Table III-1 CHEMICAL CONTENT OF REPRESENTATIVE OFFSHORE BRINES 1/

Offshore Louisiana

Component		High Solids		Average Solids		Low Solids	
		mg/1 2/	%	mg/1	%	mg/1	%
Iron	FE	153	0.057	15	0.011	139	0.226
Calcium	Ca	17,000	6.287	4,675	3.294	772	1.254
Magnesium	Mg	2,090	0.773	1,030	0.726	152	0.247
Sodium	Na^+	84,500	31.250	49,120	34.612	22,651	36.800
Bicarbonate	HCO_3	37	0.014	100	0.070	933	1.516
Sulfate	$SO_4^=$	120	0.044	0	0	188	0.305
Chloride	Cl^-	166,500	61.575	86,975	61.287	36,717	59.652
Total Solids		270,400	100%	141,915	100%	61,552	100%

1/ From U. S. Geological Survey, Oil and Gas Supervisor, Gulf of Mexico Area. New Orleans, Louisiana (1975).

2/ mg/1 is equivalent to part per million.

The six most toxic elements for marine organisms are considered to be mercury (Hg), cadmium (Cd), silver (Ag), nickel (Ni), selenium (Se), and lead (Pd). Produced waters do not normally contain concentrations of these six elements greater than those found in seawater. Recently, attention has been paid to the determination of the two most toxic elements (Hg and Cd) in effluents from a number of crude oil offshore production units. In essentially all samples examined, values were below the levels of detection which were <50 parts per billion Cd and <0.5 part per billion for Hg. Of lower toxicity, but still of concern, are copper (Cu), chromium (Cr), arsenic (As), zinc (Zn), and manganese (Mn). There seems to be no damage caused by the low levels at which these trace elements are present in produced waters.

There is an increasing body of evidence indicating that there are natural processes operating to reduce both the concentration and toxicity of trace metals dissolved in water. In order for a heavy metal to be toxic it apparently must be in the ionic state. In most natural waters much of the free metal ions would probably be bound to organic substances, naturally present in the water, decreasing the relative percentage of the ionic species. There is indirect evidence that organically chelated heavy metals in aqueous solutions do not have as great an effect upon organisms as do solutions of the metal salts. This could be due either to the fact that the organo-metallic complex is too bulky to enter a biological system or it could be due to the lack of availability of the metal for reaction with enzymes within the cells.

In addition to the possible environmental effects of trace elements in offshore produced waters, there are some additional components and properties of produced waters which have potential for minor environmental effects. These are salinity, dissolved oxygen, organic compounds other than hydrocarbons, and temperature.

Salinity—Many offshore produced waters have higher concentrations of dissolved solids than the waters surrounding the platforms. The average total dissolved solids content for produced formation waters from offshore Louisiana production facilities is approximately 110,000 mg/liter (ppm), compared with 35,000 mg/liter for normal seawater. Since we are dealing with dissolved components, dilution occurs quite rapidly when the produced waters are discharged into the waters surrounding the platform. Any environmental effects will be extremely localized near the point of discharge. Mackin (1973) states, "This dilution in large water bodies and comparatively deep water is almost instantaneous, and dilutions of 1,000 parts of seawater to one of brine can be effected in even comparatively shallow water in distances of from 8 to 50 feet. In offshore waters in the Gulf or elsewhere, there is no brine problem for that reason."

Salinity measurements were made at 180 different sampling stations offshore and in Timbalier Bay (Louisiana) in the Offshore Ecology Investigation conducted in the northern Gulf of Mexico by Gulf Universities Research Consortium (GURC, 1974). Variations were correlatable with season and geography of sampling sites and all variations were within the ranges reported by season.

In an M.I.T. study (1973) it was stated that the continuous discharge of production waters from platforms does not appear to be a serious threat to the environment. No adverse effects of discharges have been noted in the Gulf of Mexico. It is well known that the area under platforms supports unusually dense populations of various marine organisms.

Dissolved oxygen—Since oxygen is also a dissolved molecular species, the above comments about dilution certainly apply here as well. Also, the GURC (1974) study found that natural processes (tides, floods, droughts, etc.) completely overshadowed any changes in dissolved oxygen content which might have been caused by the discharge of production waters. No significant depletion of oxygen was observed at platform sites and what small reduction was noted could be explained by the generally rich biota living on the platform legs.

Organic compounds, other than hydrocarbons—Other organics found in platform production waters will usually be present in even lower concentrations than the petroleum hydrocarbons associated with these waters. These other organics would likely be in the few ppm range and dilution would rapidly disperse them below the limits of any adverse environmental effects.

In the GURC study measurements were made of the organic carbon content in the waters around two producing platforms and a control area some six miles away. Typical organic carbon contents measured around the platforms were 5.8 and 5.0 mg/liter (ppm), respectively, and 5.1

mg/liter (ppm) for the control area. Since these values are all within the sampling variability, it was indicated that there was no significant build-up of organic compounds in the vicinity of the producing platforms.

Temperature—Production waters tend to be somewhat warmer than the water surrounding the platforms, but here again, the differences are not likely great. As with dissolved species, dilution would almost instantaneously diminish any temperature gradients. In the GURC study temperature measurements were also made at some 180 different sampling stations offshore and in Timbalier Bay. As was found with salinity, the temperature variations correlated with season and nearness to shore, and no impact of the platforms and their discharges on the water temperature was noted.

4. Pipelines

Transportation of the products which may be produced from this proposed sale may require the installation in OCS waters of between 161 and 322 km of pipelines. However, no new pipelines are anticipated to come ashore as a result of this proposed sale. Installation of pipelines will require the jetting or cutting of these lines into the sea bottom to a minimum depth of .9144 m (3 Ft.). The suspended sediments fall diffusely along either side of the trench and the pipeline eventually becomes covered by the reworked sediments. Turbidity created by such an operation, although temporary, must be considered disturbance to organisms in the vicinity. In the offshore area where pipeline burial is required an estimated 4,921 to 9,841 cubic meters of bottom material is disturbed for each kilometer laid (Table I-1). This will violently disrupt the ecology of the affected area, but long experience in the Gulf of Mexico indicates that repopulation takes place quickly (within a year) and that there is no long term loss of biological productivity. In addition, chronic oil leaks are potential effluents from transportation via pipeline.

5. Oil spills

All phases of petroleum development from exploration to processing have the potential for contributing to oil spills. As oil spills are recognized as the most common cause of environmental damage associated with offshore petroleum development, considerable discussion follows on the causes and effects of oil spills.

The most important feature of oil spill statistics as reported by CEQ (1974) is the size of individual spills which range from a fraction of a barrel to over 15,000 barrels. Most spills are at the low end of this range; in 1972, 96% of spills were less than 24 barrels (100 gallons). A few very large spills account for most of the oil spilled (the Torrey Canyon accident of 1967 in Great Britain spilled twice as much oil as was reported spilled in the United States in 1970). In 1970 and 1972, three spills each year accounted for two-thirds of all oil spilled in the U.S. in those years. Because amounts spilled per incident can vary by a factor of one million, it is meaningless to estimate average amounts of oil that might be spilled during development. Data supplied by the Geological Survey for the period of 1964-1975 indicate a total of 26 major oil spill incidents connected with Federal OCS oil, gas and condensate (Table III-2). The estimated total volume of oil spilled during this period as a result of these incidents is at least 342,345 barrels (14.4 million gallons). Table III-2 compares oil spill incidents to total production for the years 1964-1975.

Pipeline Accidents

There have been 26 reported pipeline breaks and leaks, of greater than 50 barrels each, in the Gulf of Mexico since 1967. The two major causes of pipeline accidents are anchor dragging and internal corrosion. The total volume of oil spilled due to these accidents is approximately 202,588 barrels. This volume amounts to .007% of the total Gulf of Mexico OCS production since 1967. Assuming the USGS estimates of recoverable resources for this proposed sale of 100-200 million barrels, from 7,000 to 14,000 barrels could be spilled from pipelines as a result of this proposal.

It should be pointed out at this time that the above figures represent spills of greater than 50 barrels only. Although spills of this size and lower are required to be reported, information has not been developed concerning lesser pipeline breaks and leaks.

Oil and/or Gas Well Blowouts

It is possible for oil or gas wells to blow out of control during drilling operations, completion and production. Blowouts may be prevented during drilling by increasing mud weight and activating blowout preventers. When a well is completed, a subsurface safety device is installed to prevent the well from blowing out if surface control is lost.

Table III-2 OIL SPILL INCIDENTS - GULF OF MEXICO OCS

Calendar Year	Incidents	Oil Spilled	Number of Fixed Structures	Annual OCS Production
1964	5	14,928 barrels	1,100	123 million barrels
1965	2	2,188 barrels	1,200	145 million barrels
1966	0	None	1,325	189 million barrels
1967	1	160,639 barrels	1,450	222 million barrels
1968	1	6,000 barrels	1,575	269 million barrels
1969	6	30,024 barrels	1,675	313 million barrels
1970	3	83,895 barrels	1,800	361 million barrels
1971	1	450 barrels	1,891	419 million barrels
1972	0	None	1,935	412 million barrels
1973	4	22,175 barrels	2,001	395 million barrels
1974	2	22,046 barrels	2,054	361 million barrels
1975	1	Unknown	2,079	*328 million barrels
	26	342,345 barrels		*3,537 million barrels

*Estimate

Source: USGS, Conservation Division, Metairie, La. July, 1976.

A gas well blowout will cause little or no environmental damage because the gas will either burn or dissipate into the atmosphere. An oil well blowout can release large quantities of drill muds and cuttings sediment, as well as oil and gas into the marine environment.

Gulf of Mexico OCS statistics indicate that an average of one blowout occurs for every 245 wells drilled, spilling approximately 1294 barrels of oil each. Not one pollution incident by blowout, greater than 200 barrels, has occurred since 1971 (USGS, 1976). Most blowouts causing spillage result from producing oil wells, not wells being drilled. Producing oil well blowouts are normally a result of equipment malfunctions, workover procedures, human errors, storms and collisions.

It is estimated that between 100 and 300 production wells will result from this proposed sale. Based on Gulf of Mexico statistics, it is possible that up to two blowouts could result from exploratory drilling, production or completion.

Oil Spills Resulting From Explosions and Fires

Combustible hydrocarbon liquids or vapors making contact with arcing electrical or overhead mechanical devices are thought to cause most platform fires. More rarely they are ignited by lightning or static electricity. Sometimes platform fires involve the accidental ignition of fuel, solvent or heat exchanger fluids.

If producing wells are damaged to the extent that oil flows freely and ignites, they are usually allowed to burn while remote control operations are underway. In this way, most hydrocarbon liquid expelled by the well burns, reducing the fire hazard during relief operations and lowering the volume of oil dispersed into the ocean. If a blowing well is releasing mostly natural gas, ocean pollution is minimal. However, personnel and the platform or drilling structure are imperiled in the event of a fire.

From 1956 to 1976, many platform fires of varying sizes occurred during OCS production. Most were extinguished without causing serious damage or pollution. Of 180 recorded explosions and fires, nine had spills totalling 87,112 barrels. When the amount spilled is compared to total production of 3,537 million barrels, the annual spillage rate is 0.0025 percent. Assuming a 25-year life of discovered fields and a 200 million barrel total production, approximately 197 barrels of oil could be spilled per year as a result of the proposal.

Tanker Accidents and Operations

Accidents, carelessness or mismanagement releases almost 36.5 million barrels of oil annually into the world's ocean (Charter et al., 1973). Figure III-1 shows the percentage of total overflow from various polluting sources (Porricelli and Keith in press). Table III-3 shows the budget of petroleum hydrocarbons introduced into the oceans as compiled by the National Academy of Sciences (NAS, 1975).

About 98% of all of the oil spilled by vessels is from incidents involving over 1,000 barrels. Most large tanker spills occur nearshore (within 80 km of land) when the vessel runs aground, rams a fixed structure or collides with another vessel.

During 1973, approximately 1,404 billion tons of oil were transported by tankers; about 1,355 billion tons of crude were similarly transported during 1971 (National Academy of Sciences, 1975). Ten billion barrels will be used in the spillage rate calculations.

From 1969 to 1973, a total of 950,000 long tons of oil were spilled by tankers (Card et al., 1975; average annual spill volume was 190,000 long tons (13.5 million barrels). A ratio of volume transported (10 billion barrels) to volume spilled (1.35 million barrels) results in a spillage rate of 0.013%. The CEQ (1974) report lists a spillage rate for tankers of 0.016%. Tankers probably will not be used to transport production from offshore to onshore facilities as long as pipelines are technically and economically feasible. Pipelines will carry the production from offshore platforms to onshore storage facilities.

Minor Spills and Natural Seeps

Table III-4 lists annual totals of minor spills by number and volume. It should be noted that not all oil slicks are related to offshore drilling, transportation or production.

Most of the oil seeps that have been noted in the Gulf of Mexico are currently active. Studies were conducted by the USGS around the Gulf of Mexico to determine (1) whether previously reported seeps are still active; (2) the characteristic of the seeping hydrocarbons; and (3) the amount of bitumen (asphalt found in a natural state) contained in the drainage leaving the seeps and entering the Gulf of Mexico.

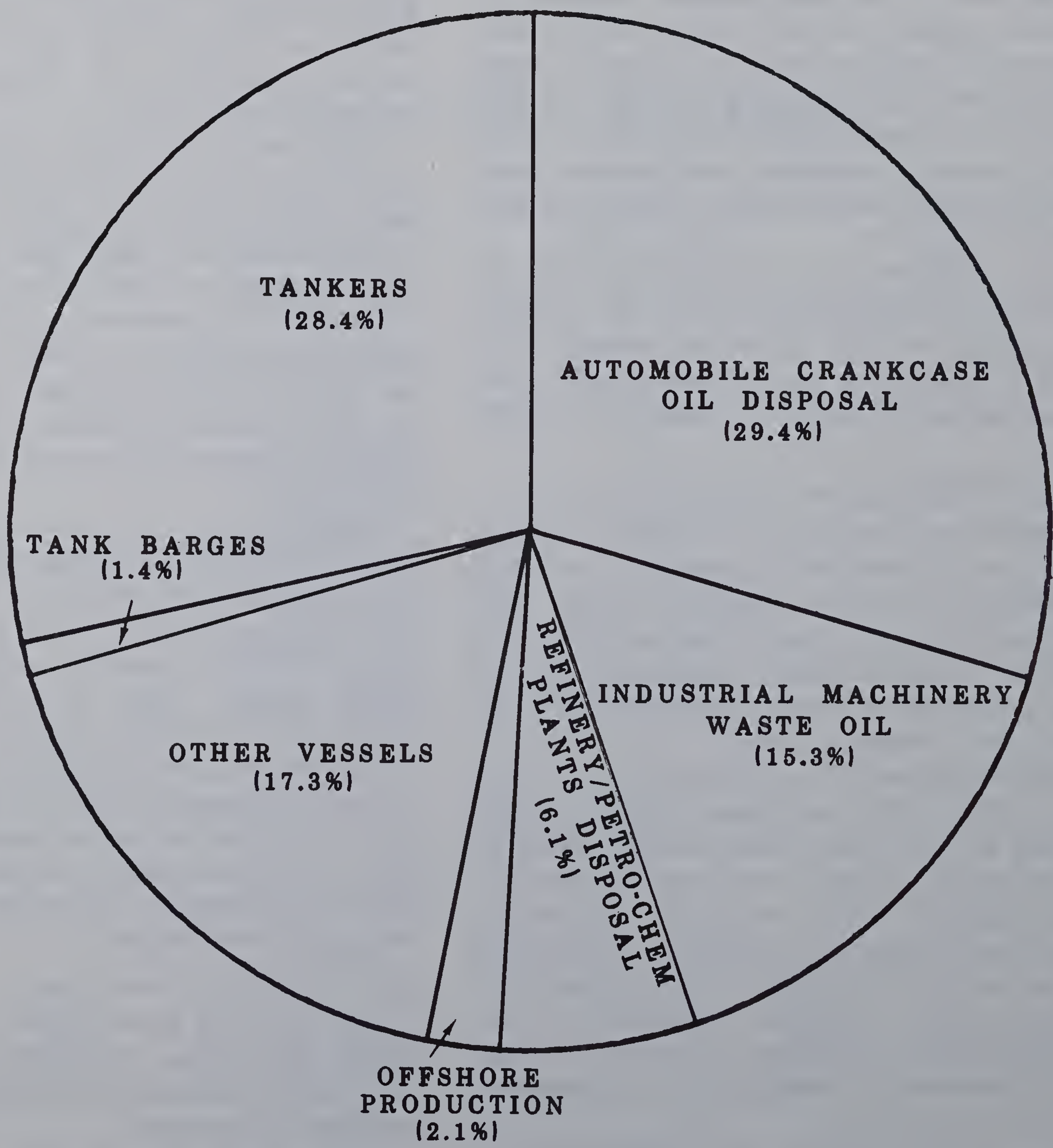


Figure III-1 Sources of Oil Pollution to the Oceans.

Source: Porricelli and Keith, 1973

Table III-3. Budget of Petroleum Hydrocarbons Introduced into the Oceans

Source	Input Rate (mta)[a] Best Estimate	Probable Range	Reference
Natural seeps	0.6	0.2-1.0	Wilson et al. (1973)
Offshore production	0.08	0.08-0.15	Wilson et al. (1973)
Transportation			
LOT tankers	0.31	0.15-0.4	Results of workshop panel deliberations
Non-LOT tankers	0.77	0.65-1.0	
Dry docking	0.25	0.2-0.3	
Terminal operations	0.003	0.0015-0.005	
Bilges bunkering	0.5	0.4-0.7	
Tanker accidents	0.2	0.12-0.25	
Nontanker accidents	0.1	0.02-0.15	
Coastal refineries	0.2	0.2-0.3	Brummage (1973a)
Atmosphere	0.6	0.4-0.8	Feuerstein (1973)
Coastal municipal wastes	0.3	-	Storrs (1973)
Coastal, Nonrefining, industrial wastes	0.3	-	Storrs (1973)
Urban runoff	0.3	0.1-0.5	Storrs(1973)Hallhagen(1973)
River runoff	1.6	-	
TOTAL	6.113		Storrs(1973)Hallhagen(1973)

Table III-4 Minor Oil Spills

Year	Total Number Report	Total Number Volume
1971	1,245	1,493
1972	1,159	1,032
1973	1,171	921
1974	1,129	667
1975	1,126	711

Year 1970 was the first year for minor spill reporting, and the 1970 data is not suitable for this table.

Source: USGS, 1976. Comments on Draft EIS 47.

When total minor spills in barrels per month are plotted against time, a smooth curve representing a constant 2.57% decline is noted. During the period 1970-1973, total oil and condensate production varied by less than 13%, whereas minor oil spill volume decreased almost 60%.

From 1970 to 1974, the spillage rate was 0.000274%. Projecting this rate to the present proposal's estimated maximum yearly production of 10.95 million barrels, the maximum minor spill level is 30 barrels per year. If the downward trend of minor spill volume continues, this figure could be somewhat smaller.

Accidental Spills From Overflow, Malfunction, Rupture or Failure of Platform Piping Valves

These are minor spills in which 50 barrels or more were lost before the condition was corrected. Accident records for the Gulf of Mexico indicate 12 such spills through 1973. Total spillage was 1,558 barrels, or an average of 130 barrels per spill.

Assuming these conditions, the rate of 1,558 barrels spilled to 2.9 billion barrels produced is 0.000054%. At a maximum production of 11 million barrels per year, the spillage in the proposed lease area could be six barrels per year.

Oil Spills Caused by Natural Phenomena

The preceding section dealt with estimates on the volume of oil that may be spilled annually as a result of human error and equipment failure. This section is devoted to oil spill probability estimates due to natural phenomena in the proposed sale area. The discussion, with minor changes, is taken from the CEQ (1974) report which estimated the likelihood of natural phenomena damaging or destroying an offshore structure and likelihood of a particular event.

Major offshore structures are designed to withstand an environmental stress as specified by the future owner or operator. Typically, forces associated with the 100-year storm have been the specified stress. However, there is always a chance that these forces will be exceeded, resulting in an oil spill. For example: Over a 30-year field life, the probability of at least one storm with forces greater than the 100-year storm is 26%; with forces greater than the 200-year storm, there is a 14% probability.

Based on several assumptions, including: the probability that a natural event will occur is adequately described by recurrence relations given in previous sections of their report; structural designers can develop designs that will withstand the forces of specific natural events (e.g., earthquakes with magnitude less than 7.2), and that a specific natural event will occur in the vicinity of an oil field, exposing the structures to the full forces associated with the event; the CEQ calculated the number of times oil spills can occur due to natural phenomena.

The field life (production period) of an oil reservoir depends on reservoir volume, depth of water at the site, amortization costs, and time required to develop the field. Based on past industry practice, field for the northern Gulf of Mexico reservoirs will probably be between 20 and 40 years. Calculations were therefore made for 20-year, 30-year, and 40-year field lives.

Since 1964, two mobile drilling rigs and 19 platforms have been lost or damaged by hurricanes; an unspecified amount of oil spillage occurred when production platforms were lost:

Hurricane	Mobile Drilling Rigs Lost	Platforms Lost
Hilda (1964)	1	12
Betsy (1965)		5

Estimate of the Likelihood of Platform Collapse and Well Blowout from Storms

Unprotected wells can blow out if the platform collapses from excessive storm forces. The probability of a storm exceeding the design has been calculated from design specifications of both 100- and 200-year storms with safety factors of 1.5 and 2.0. The analysis further assumed the platform would experience the full effects of a storm exceeding the design spectrum. If a platform collapses, conductor pipes will shear. However, the positive open control lines to the subsurface valve will also shear thus closing the valve and preventing loss of oil. Valves are not 100% reliable; however, recent tests show a 0.96 to 0.97 reliability. CEQ used 0.96 for their calucations. Industry is sponsoring research to identify the failure modes of subsurface valves to improve design and thus increase reliability. To show how improved reliability would reduce failure rates, the CEQ also selected a valve reliability of 0.99 for their calculations.

The value of improving reliability is illustrated in the following examples: A platform in a proposed sale area is designated to withstand the 100-year storm and has a margin of safety of 1.5. If field life is 30 years, then the possibility of exceeding the platform design specifications during the life of a field is 0.14 (or 1 chance in 7). If subsurface valving is installed, the chance for a blowout is 0.0006 (1 chance in 700) for a reliability of 0.99.

Table III-5 illustrates two important points. First, likelihood of platform collapse increases linearly as the age of the field increases and decreases linearly as the design storm criteria is increased. For example, a platform designed for the 100-year storm in a 20-year field will have the same likelihood of failure (0.09) as a platform designed for the 200-year storm in a 40-year field.

Estimates of the Likelihood of Oil Spillage From Storage Systems

The three types of OCS storage facilities are onshore, floating, and underwater facilities. Government regulations now require that dikes enclose onshore tanks so that if the tank fails, the released oil will not escape from the area. CEQ maintains, therefore, that the chance of oil spills due to natural phenomena is zero, provided dikes are not damaged. Damage to dikes is very dependent on quality of the soil foundation. It is extremely important that a thorough geologic investigation of the proposed site be made to confirm that the soil properties are satisfactory.

Likelihood of failure has been calculated for floating and underwater storage (CEQ, 1974). Storms are the only natural phenomena affecting floating storage placed in deep water. The same linear relation exists between field life and more stringent design criteria. That is, if field life is doubled, then the recurrence interval for the design storm should be doubled, to maintain the same probability.

These estimates are based on the likelihood that a floating storage tank will break its moor and go adrift. If capsizing or grounding can be avoided, and if service craft can regain control of the drifting tanks, oil spillage will be averted. A spar-type floating storage will minimize capsizing. This system uses long vertical cylinders which are very stable and experience very little motion even in heavy seas. However, since it will usually extend several hundred feet below the surface, it must be moored in deep water.

Estimates of the Likelihood of Natural Phenomena Damage to Transportation Systems

Properly designed, constructed and emplaced pipelines are relatively insensitive to all natural phenomena except ground facilities and slumping along the pipeline route. The possibility of soil stability loss cannot be assessed until after a thorough geologic analysis of the selected route and after selection of a valve location program. These steps are taken during the late stages of the exploration program and follow the decision that the reservoir warrants development.

It is BLM policy to cooperate with State efforts to identify and designate the least environmentally hazardous areas of their coastal zones and territorial waters from potential new OCS pipeline rights-of-way.

Oil Spill Trajectories in the Gulf of Mexico

Oil spills on the ocean surface are usually described in terms of spreading, drifting, and weathering. However, a combination of many factors controls oil movement and composition. A partial list of these factors includes: original composition, age, solubility, total amount introduced, concentration, dilution, evaporation, photo oxidation, absorption on suspended particulates, microbial degradation, spill treatment, water salinity, temperature, waves, winds, currents, season, geographical location, and climate.

There have been no comprehensive oil spill trajectory models developed for the Gulf of Mexico. There have been, however, two oil spill trajectory computer simulations done for the Gulf of Mexico. One model was prepared for three possible deepwater port locations, one in Texas, one in Louisiana, and one in Alabama. A second trajectory model was prepared in the South Texas Baseline Study. "The trajectories presented in this report were based on analytical work by Reid (1975) and a numerical model developed by Whitaker and Vastano (1975)". In general, the results of these models predicted landfalls when prevailing winds were onshore and away from the coast when winds were northerly or westerly. It is clear from this conclusion and from the actual trajectory of the oil spilled from the *Argo Merchant* off New England in December 1976 that wind is the dominant factor in determining where the oil will go.

Summary and Conclusions

Table III-6 summarizes the effects of several oil spills on the environment.

TABLE III-5

Estimate of Platform Collapse and Well Blowout
(Safety Valve Reliability - 0.96 and 0.99)

Field life in years

Severe storm design standard	20	30	40	Remarks
100-yr storm				
Margin of safety - 1.5	.09/.0036/.0009*	.14/.0056/.0014	.19/.0076/.0019	Average number of times severe storms will cause well blowout
Margin of safety - 2.0	.04/.0016/.0004	.07/.0028/.0007	.08/.0032/.0008	
200-yr storm				
Margin of safety - 1.5	.05/.002/.0005	.07/.0028/.0007	.09/.0036/.0009	
Margin of safety - 2.0	.02/.0008/.0002	.03/.0012/.0003	.04/.0016/.0004	
Combined Severe Storm and Tsunami				
100-yr storm	.001/.00004/.00001	.0015/.00006/.000015	.002/.00008/.00002	
200-yr storm	.0005/.00002/.000005	.0007/.000028/.000007	.001/.00004/.00001	

*Platform Collapse/Well Blowout = 0.96/Well Blowout R = 0.99
Reliability = 0.96/well blowout
R = 0.99

Source: CEQ 1974

Table III- 6 . A Summary of Several Oil Spills Followed by Studies of Their Environmental Impact.

Date of Spill	Source and Location	Type and Amount of Oil(barrels)	Shoreline Affected (mi)	Localities Studied	Species Identified	Sampling Method	Biological Damage	Reference
March 1957	Tampico Maru, Baja California, Mexico	Diesel oil 60,000	2	Intertidal & subtidal	Larger visible plants and animals	Qualitative, quantitative macrocystis counts	Nearly total devastation immediately, luxuriant growth of seaweed developed within months; biota 90% restored after 3 or 4 years, although relative abundance of certain species still somewhat changed after 12 years	North et al., 1964; Mitchell et al., 1970
July 1962	Argea Prima, Guayanilla Harbor, Puerto Rico	Crude oil 70,000		Mangrove shores; intertidal and subtidal	Blue-green algae	Qualitative	Extensive damage: high mortalities among many shallow water and shore-dwelling organisms, including a wide variety of vertebrates; also extensive damage to intertidal and sublittoral algae and mangrove habitat	Diaz-Piferrer, 1962
Jan. 1967	Chryssi P. Goulandris, Milford Haven England	Crude oil 1,800		Intertidal salt marsh; intertidal rocky shore	Grasses	Semiquantitative rocky shore transect; quantitative studies of grasses	Most damage to intertidal organisms; gastropod molluscs badly affected, also barnacles and sea anemones on a number of shores; no apparent damage to algae	Cowell, 1969; Nelson-Smith, 1968
March 1967	Torrey Canyon, S.W. England	860,000		Intertidal rocky shores and sand beach	Larger visible animals only	Semiquantitative rocky shore transects; qualitative beach and subtidal surveys; quantitative algal counts	Very high mortalities of intertidal shore life, mostly due to use of toxic emulsifiers; many invertebrates and algae killed on shores; fisheries and plankton apparently unaffected; estimated 10,000 birds killed	Bellamy et al., 1967; Smith, 1968
Sept. 1967	R.C. Stoner, Wake Island	Aviation gas, J-P4 jet fuel, A-1 turbine oil, and Bunker C oil 126,000		Intertidal & subtidal	Large visible invertebrates	Qualitative	Many dead fish stranded on shores; also abundant dead molluscs, sea-urchins, and crabs	Gooding, 1968
March 1968	Ocean Eagle, San Juan Harbor, Puerto Rico	Crude oil 83,000		Intertidal rocky shore	15 large sp.	Qualitative	Many subtidal and intertidal organisms killed or damaged by oil or oil and emulsified, including molluscs, crustaceans, and algae, although subsequent recovery good; 10 species of fish found dead or in state of stress	Cerame-Vivas, 1968

Table III-6 (continued).

April 1968	Esso Essen, S. Africa	Crude oil 20,000-28,000		Intertidal & subtidal	No species identifications, observations on larger organisms	Qualitative	High mortalities of sandhoppers (amphipods) but otherwise little damage on shores; high bird mortalities	Stander and Ventner, 1968
Dec. 1968	Witwater, Galeta Island, Canal Zone	Diesel and Bunker C oil 20,000		Rocky intertidal coral reef, sandy intertidal mangroves	Uca, mangrove species, four coral species	One quantitative sand sample for meiofauna; otherwise qualitative	On rocky shores, extensive mortality of supralittoral vegetation and tide pool life; on sandy beaches, great population decreases among meiofauna, especially crustaceans; many young mangroves killed in swamp areas, also algae and many invertebrates; coral reefs apparently unharmed	Rutzler and Sterrer, 1970
Jan. 1969	Well A-21, Santa Barbara Channel	Crude oil 33,000	40	Intertidal & subtidal	Subtidally: selected polychaete families, ophiuroids, and molluscs not including smaller polychaetes and amphipods; intertidally: visible rocky shore species and 195 sp. retained by 1.5mm screens in sandy areas	Grab sample, qualitative at species level; quantitative for biomass line transects on rocky shores; 1/100 m^3 samples on beaches	High mortalities of intertidal organisms covered with oil; about 3,600 birds killed; no apparent effects on fish and plankton; no directly attributable damaging effects of oil on large marine mammals or on benthic fauna; area recovering will within a year	Cimberg et al 1973; Fauchald, 1971; Foster et al, 1971a,b; Nicholson and Cimberg, 1971; Straughan, 1972
Sept. 1969	Florida, West Falmouth, Mass.	No. 2 fuel oil 4,500	3	Intertidal mud and sand flats; subtidal to 10 mm	All animals 0.247mm, excluding nematodes, copepods; ostracods and unicellular organisms, including smaller polychaetes and amphipods	Quantitative transects	Severe pollution of sublittoral zone, with 95% kill of all fauna, including many fish, worms, molluscs, crabs, lobsters, and other crustaceans and invertebrates; local shellfish industry severely affected; Wild Harbor still closed to shellfish fishing in May 1974	Blumer and Sass, 1972; Blumer et al., 1970a,b
Feb. 1970	Arrow, Chedabucto Bay	Bunker C 108,000	12	Intertidal rocky shore; intertidal lagoon	Common visible species on rocky shore and species 74 mm in lagoon samples	Semiquantitative transects; 2 samples in lagoon	Localized damage to intertidal life, where most mortalities were crabs, limpets, and algae, probably killed by smothering; local fish catches normal; about 2,300 birds killed; 5 months after spill, subtidal flora and fauna healthy; fishing and lobstering normal	Thomas, 1973; Navships, 1970
Jan. 1971	Arizona Standard and Oregan Standard, San Francisco Bay	Bunker C 20,000	60	Intertidal & subtidal rocky shore; intertidal sand beach	31 larger sp.	Quantitative transect counts	Some damage to shore life, mainly to acron barnacles, limpets, mussels, and striped shore crabs; 3,600 birds killed; area nearly normal within 1 year	Chan, 1973

Table III-6. (continued).

Feb. 1971	Wafra, Cape Aulhas, S.Africa	Crude oil 445,000	10	Intertidal rocky shores	Larger intertidal rocky shore species	Qualitative	Little damage to intertidal life; 1,135 black footed penguins found oiled	Day et al., 1971
April 1971	March Point Dock Facility, Anacortes, Washington	No. 2 fuel oil 5,000	20	Intertidal beaches, rocky shores, subtidal	Animals 4mm in subtidal samples, visible fauna identified to major taxa only	Quantitative grabs; quantitative intertidal transects	Some oil on shores, damaging shellfish, limpets, crabs, clams and oysters; about 1,000 birds involved	Watson et al., 1971; Woodin et al., 1973
Jan. 1972	General M.C. Meigs, Wreck Cove, Washington Coast	Navy special oil 3,000	300-500 yd	Intertidal rocky shores	37 sp. algae, sp. animals not including smaller polychaetes and amphipods	Quantitative transects	Urchins affected; plant community showed less of fronds and bleached thalli	Clark et al., 1973

Source: National Academy of Science, Petroleum in the Marine Environment, 1975.

The stability of soil beds including faulting also threatens pipelines. Careful route planning and an adequate valve program may relieve some risk.

Several typical oil production systems have been evaluated from the aspect of minimizing oil spillage. Pipeline and onshore storage is considered best for this proposed sale area. Floating moors rather than fixed berths for tankers represent a lesser risk of massive oil spillage (CEQ, 1974).

6. Onshore Development

Development of oil and gas resources offshore requires onshore, coastal area support facilities. Staging areas from which equipment, supplies and personnel can embark and return; hydrocarbon storage and transfer facilities; pipeline landfalls; offshore equipment construction areas; offshore equipment supply depots; and refineries are typical facilities often located on coastal areas near sources of supply and demand. Ongoing and long established onshore support facilities along the Gulf of Mexico should be adequate to accommodate estimated production from this proposed sale. Considering overall production declines in the Gulf of Mexico since 1975 it is likely new discoveries will utilize support facilities already in existence. The possibility exists, however, depending on the location and magnitude of actual discoveries that some new onshore facility may be required. The USGS has estimated 0-32 hectares may be required onshore in support of the proposed sale.

Portions of the Louisiana and Texas coasts have a developed gas and oil related infrastructure in the form of service, support, production, transportation, storage, processing, and other facilities. The activities and facilities required by this proposed sale will therefore fall within the broad framework of similar activities and facilities in this and other proposed sales adjacent to the Gulf of Mexico.

The extent of the existing facilities in the Gulf of Mexico area have been previously described in Description of the Environment: History and Projected Economic Growth (Section II.I.).

It is assumed that sale-induced support facilities will tend to locate in areas presently committed to similar facilities and inducements. Areas presently committed to a highly developed gas and oil related infrastructure are expected to have a greater tendency toward, and land use precommitment to, expansion of these activities than will those areas with a low or non-existent level of development. Should new incremental requirements be induced by this proposed sale, they will essentially be an expansion of the present capabilities; such a requirement is not considered likely.

The anticipated production resulting from this proposed sale will require the installation of offshore pipelines to link the new wells and production facilities to the existing offshore pipeline network. An estimated maximum of 282 km of pipeline would be required for this purpose. To the extent that one of the interstate pipelines supplied from this area is currently curtailing deliveries, there should be spare onshore pipeline capacity to deliver part if not all, of the new supplies resulting from the development to be included in this proposed sale, and thus no new pipelines coming ashore are expected.

It is assumed that all oil production will be pipelined to shore, stored in oil tank farms, and finally transferred to existing refineries by means of existing pipelines or tanker and barge facilities.

Production from offshore areas will tend to offset declining onshore and current offshore production. Since demand for petroleum products is not expected to diminish, the capacity of the refineries of the area will be met by importing crude if domestic production does not provide enough. Thus, the production resulting from this proposed sale is not expected to add to the total production of the Gulf states, but rather will take the place of declining production elsewhere in the Gulf as well as reduce the need to import even more foreign oil. Location and volume of Gulf of Mexico refining capacity is provided in Table II-43.

The principal effect of this proposed sale on the industrial environment of the coastal areas of the Gulf of Mexico is believed to be to preserve and maintain the existing industrial and economic activity in the region.

The extent to which crude oil and condensate produced from tracts leased as a result of this proposed sale will displace imported crude oil and condensate will probably be dependent, in a large part, on the relative price of domestic crude oil and imported crude oil.

The following comparisons are based on tables published in the December 1976 issue of Monthly Energy Review, a publication of the Federal Energy Administration.

During September 1976 approximately 53% of the domestic crude oil production was valued at the wellhead at $5.17 per barrel. This oil is referred to as old oil and is subject to price control. The remaining domestic crude oil production is referred to as new oil or stripper oil and is sold at higher prices. During September 1976, 34% of domestic production was classified as "Upper Tier" with a price of $11.65 per barrel, and 13% of domestic production was classified as "Stripper" with a price of $13.21 per barrel.

A preliminary estimate of the average cost for all domestic crude petroleum delivered to refiners during September 1976 was $8.93 per barrel. The refiner cost of imported crude petroleum was estimated to be $13.50 per barrel during September 1976 or approximately $4.57 more than the refiner's average cost of domestic crude. A comparison of refiner acquisition cost of new oil with the landed cost of imported crude is difficult, due to the necessity of adding transportation costs to the wellhead price of new oil in order to arrive at a comparable cost to the refiner, but it appears probable that new domestic crude petroleum would be less costly than imported crude petroleum.

On December 22, 1975, the President signed into law the Energy Policy and Conservation Act, and at the same time removed the $2 per barrel fee on imported crude oil. Among other provisions, the Emergency Petroleum Allocation Act of 1973 has been amended to establish a composite selling price of $7.66 per barrel for all first sales of crude oil produced in the U.S., beginning in February 1976. The $7.66 can be increased at the discretion of the President, beginning in March 1976, to adjust for inflation and to provide an incentive of not more than 3% per year. However, both adjustments may not exceed 10% per year without the approval of Congress. The Act authorizes a gradual phase out of mandatory domestic price controls over a 40-month period.

"Support facilities" are a wide variety of supply and service oriented industries having capabilities to support the exploration, development, and production, and transportation of gas and oil. The term includes those companies dealing with tools, wireline, gas life, cement, boats, etc., as well as machine and welding shops, trucking firms, wellhead and mud suppliers, supply stores, etc. Such capability is present in many industrialized areas within the Louisiana and Texas coastal areas, and it has been assumed that capabilities exist in virtually all sectors which will be utilized by sale related demands. It is not anticipated that the proposed sale will create new demand for lands dedicated to these uses.

Industrial development was used as the basis for land use requirements, as its site demands are most relevant to sale related activities. However, in doing so, it is understood that this land use represents only one component of a balanced land use/population ratio. New industrial development induces new employees and activities into the general proposed sale area, and these will be distributed to more specific areas. This suggests land use implications beyond these specifically addressed because of requirements for residential, commercial, recreational, and other land use categories.

Any population or industrial inducement can be perceived as creating environmental stress for a localized area or general region. Conversely, shifting or developmental pressure to such areas can be perceived as relieving stress in other areas. Whether the result is a net gain or loss of environmental stress is partially dependent on the relative stresses experienced in the areas which gain or lose population and the capability of the receiving area to accommodate new development. It is axiomatic that stress induced into an area can often be mitigated by rationally developed, goal oriented policies and land use plans. Subsequent allocation of land in response to these demands remains a responsibility of State, regional, and local governments. Because of the time lag between the proposed lease sale and the resulting land use impacts, there is sufficient lead time for these entities to develop responsive land use plans and policies.

B. Impact on the Living Components of the Environment

1. Impact on Phytoplankton

The oil and gas exploratory phase will have a localized effect on the phytoplankton in the vicinity of each exploratory well by the presence of turbidity plumes created by the disposal of drill muds associated with the cuttings. If we assume that these operations create a plume 20 m wide and 800 m long (plumes of this approximate size have been observed in the Gulf of Mexico) then the euphotic zone will be reduced under 16 ha of sea surface for the duration of drilling (approximately 15 days). The residence time for any single phytoplankton within this reduced euphotic zone would depend on the vertical and horizontal transport to which it is subjected.

The field development phase will have similar impacts only with longer duration. Assuming that a maximum of 20 wells will be drilled from each platform, approximately 400 drilling days would be necessary and the turbidity plume would be present during this period. This would result in a cumulative duration of 10,000 days for 25 platforms throughout the proposed sale area. This turbidity may reduce the photosynthetic assimilation of the total marine system in the proposed sale area by an amount that is presently unquantifiable.

The production phase can impact phytoplankton through the disposal of formation waters which contain the soluble fractions of crude oil at an average concentration of 30 mg/l and relict sea water with trace amounts of certain heavy metals. As mentioned above, the resultant receiving water concentration of petroleum hydrocarbons is difficult to assess, but if we assume instantaneous mixing into one cubic meter of sea water, the concentration would be approximately 30 micrograms per liter (ug/l). Gordon and Prouse (1973) have observed stimulation of phytoplankton photosynthesis by Venezuelan crude in concentrations of 30 to 50 mg/l with inhibitions at higher concentrations in studies conducted off Nova Scotia. Shields et al. (1973) found that very low concentrations of Prudhoe Bay crude stimulated Gulf of Alaska phytoplankton photosynthesis over short incubation period during December, April and June. The photosynthetic rate of June phytoplankton exposed to approximately 3 ug/l more than doubled the rate for phytoplankton in sea water containing no oil. Oppenheimer, et al. (1977) in their North Sea investigations found a tendency toward more organisms being associated with the most active oil fields. Mironov (1970), however, reports that cell division in phytoplankton was delayed or inhibited by crude oil concentrations as low as 1 ug/l. Thus minute petroleum hydrocarbon discharges from production phase may cause local stimulation of phytoplankton photosynthesis for the duration of production (approximately 20 years) in the immediate area of production platforms. But if excessive concentrations are discharged, a local inhibitory effect can be expected.

The anomalous ion rations present in formation water should cause minimal disturbance to phytoplankton due to dilution. Concentrations of trace metals contained in formation water may exceed background concentrations at the point of discharge.

However, Williams (1977) reports that his studies have shown that acute toxicity and much environmental degradation occur as a result of oil spills. He reports that the toxins are not from the oil itself but from ". . . apparently unsuspected high concentrations of some lipid soluble metals derived from the tolerant concentrations in the oceans". Williams further states that he found acute toxic effects on the nannoplankton downstream from oil rigs off Texas and Louisiana in 1975 and 1976 respectively. He does not, however, say how far downstream the effects are noted nor does he define "acute toxic effects". There is considerable controversy on this point, and the final word has not yet been written.

The transportation phase will affect the phytoplankton due to the pulse of turbid water created by pipeline burial operations. This pulse will temporarily stress phytoplankton in the immediate vicinity of the operations. If bottom areas high in heavy metals, pesticides, or other pollutants are traversed, the effects will be more severe and possibly of longer duration. Phytoplankton primary productivity will be temporarily impacted in an area approximately 50 meters wide throughout the length of the pipeline route.

In summary, there will be no significant long term detrimental effect on phytoplankton as a result of this proposed sale, nor is the cumulative effect of past and proposed future sales expected to be adverse, since operations in the Gulf tend to replace existing operations rather than add new increments to the overall activity.

2. Impact on zooplankton

Turbidity generated during the exploratory and development phases of OCS oil and gas operations may have an adverse effect on individual zooplankters in the immediate vicinity of the drilling rig. Zingula (1975) has shown that suspended solids concentrations in surface water near drilling discharges are of the order of 300 mg/l and are rapidly diluted to approximately 6 mg/l within 200 m of the discharge. An additional impact may be the temporary resuspension of bottom sediments during platform placement.

The dissolved components of crude oil present in production phase discharges may have a toxic effect on zooplankton in the immediate vicinity of the production platform. If we assume a local concentration of 30 parts per billion (ppb), direct lethality should not occur. However, Lee (1975) has shown that certain species of zooplankton can assimilate hydrocarbons from a seawater solution at low concentrations forming the necessary first step in food web concentration. Another potential effect involves the interference by petroleum hydrocarbon with chemically controlled behavior in zooplankton. The magnitude and importance of this potential impact is at present insufficiently known to allow prediction.

The use of pipelines in the transportation phase of OCS development should have a minor effect on the total zooplankton component of the marine ecosystem. Pipelaying may result in the temporary resuspension of bottom sediments and the resultant turbidity may have a severe effect on local zooplankton populations. In nearshore areas, the possibility of the liberation of adsorbed toxicants should be taken into consideration in pipeline routing since sufficient concentrations of heavy metals or chlorinated hydrocarbons to stress zooplankton may be present. Like the impact on phytoplankton, the impact on zooplankton will be local and short term. Also like the phytoplankton, past and proposed future Gulf sales will not add to the impact, but will only maintain a more or less constant level.

3. Impact on Nekton

With the use of non-explosive energy sources for seismic survey work, the pre-exploratory phase of oil and gas development should have minimal impact on the marine nekton. Falk and Lawrence (1973) report that while explosive sources killed fish over an area of thousands of square feet, the nonexplosive source tested caused no direct mortality. Weaver and Weinhold (1972) reported no harmful effects from nonexplosive sources fixed at various depths.

The exploratory phase will have a localized temporary effect on the nekton due to the physical presence of the rig and the disposal of drill muds and cuttings during the drilling of exploratory wells. The attraction of nektonic organisms, especially fish, to submerged structures is a widely recognized phenomenon and since drilling rigs are well lighted, this attraction may be enhanced at night. Observations in the Gulf of Mexico indicate that fish are also attracted to the drill cuttings as they cascade down through the water column where they may be sampled as food items and rejected. No definite bioassays have been conducted with drill muds and species found in the proposed sale area, however, Falk and Lawrence (1973) have indicated lethal concentrations of between 0.83 and 12.0% of drill mud with lake chub and rainbow trout. Experience in the heavily developed areas of the Gulf of Mexico indicates that no severe adverse effects upon nektonic populations will result from exploratory drilling.

The field development phase will entail the installation of semi-permanent (20 year average functional design life) platforms from which development wells will be drilled. The platforms, like the drilling rigs, will attract the larger organisms immediately; but due to their permanent nature, they also act as true artificial reefs with the establishment of a community of great diversity.

The production phase of offshore operations can impact the nekton through the disposal of formation waters which contain the soluble components of crude oil (30 mg/l) and trace amounts of certain heavy metals. The effects of these low-level chronic discharges are not quantifiable at present. However, due to the magnitude of dilution and the process of microbial degradation, no adverse effects upon nektonic populations have been noted in areas of intense oil and gas development in the Gulf of Mexico OCS.

The transportation phase, if by pipeline, will result in temporary, localized increases in pipelaying operations which can be easily avoided by the actively swimming nekton. No long term nor incremental adverse impacts are expected to occur to the nekton.

4. Impact on the Benthos

The exploratory phase effluents that may be expected to have an effect upon benthic organisms include drill cuttings and drilling muds (see Section III.A.2.).

The sessile benthic organisms upon which the cuttings pile will accumulate, will be buried by approximately 1,500 to 3,000 yd^3 of cuttings generated by the example exploratory wells. These cuttings may form a low mound or may be worked into the surrounding sediments. Their disposition is dependent upon the nature of the cuttings, the nature of the local sediments, the depth of disposal, the benthic fauna capable of bioturbation and/or encrustation, and the physical forces acting upon the cuttings pile.

The drilling muds which are associated with the cuttings when they are disposed of overboard, are washed from the cuttings and eventually settle to the bottom after generally a wide dispersal through the water column. Also, muds are routinely discharged into the water during drilling operations as mud mixtures are changed, and, at the completion of drilling operations, some 800 barrels of mud are discharged (Otteman, 1976). The major impact of these discharges would be to smother benthic organisms in a small area immediately adjacent to the drilling platform. Experience in the Gulf of Mexico indicates that such effects are of short duration in a small area, and that there is no long term impact. Jones and Williams (1973) found sediment barium concentrations to be above normal in areas of the Gulf of Mexico where intensive drilling has taken place. Barium sulfate is the major constituent of drilling fluids and the distribution of barium in the sediments suggest that the above-normal concentrations are due to the disposal of these fluids. Barium sulfate is a highly insoluble, nontoxic salt which is present in seawater at a concentration of approximately 0.05 mg/l and in certain localities concretions and nodules of barium sulphate are found naturally in bottom deposits. (Horne, 1969); therefore, no direct toxic effects on benthic biota are expected from the disposal of drilling fluids during the exploratory and development phases. The U.S. Environmental Protection Agency is presently conducting research which addresses the problem of drill mud toxicity to marine organisms, and BLM is continuing research into the ultimate fate of the muds.

The field development phase will require the placement of platforms and the drilling of up to 20 wells at each of a maximum of 25 platforms. The initial platform placement and anchoring may temporarily disturb the benthic biota in the immediate vicinity. Longer term effects may include a change in the benthic community to reflect the presence of an artificial reef.

The drilling of 20 wells from a platform will result in the disposal of approximately 60,000 yd^3 of cuttings which, in this area, are expected to be mainly carbonate in nature. This may result in the establishment of a different benthic community in the immediate vicinity of the cuttings pile.

The production phase will result in the introduction of the soluble components of crude oil at an average concentration of 30 mg/l. If these components become adsorbed to suspended particulates they may eventually be incorporated into the benthic environment. This will cause a shift in the sediment microflora to a community capable of utilizing petroleum hydrocarbons as an energy source. Those compounds which are not degraded may accumulate in the deeper sediment layers. No investigation that would determine if this is the case has been conducted to date in areas of offshore petroleum development.

If the transportation phase requires the installation of pipelines, certain impacts to the marine benthos will occur. In water depths of less than 61 m, new common carrier pipelines are entrenched by jetting away the sediment beneath the pipe and allowing the pipe to settle approximately one meter into the underlying trench. Partial burial takes place quite rapidly as the disturbed sediments slide and settle back into the trench.

The jetting process physically disrupts the sediments in its path, and also causes resuspension of large quantities of sediment. This process would have the effect of displacing benthic organisms and would result in direct mortality to softer life forms and indirect mortality to others through increased vulnerability to predators. Although recolonization would begin immediately, the native fauna could not be fully restored until seasonal reproduction cycles had been completed by representative species from adjacent areas; these would provide a supply of larvae to settle and enter the reworked substrate.

Turbidity resulting from resuspended sediment is capable of producing an adverse impact on filter-feeding molluscan and crustacean benthos populations by clogging the filter-feeding apparatus or blocking respiratory surfaces. This impact is temporary, occurring during burial operations, lasting from several hours to a few days, and would effect those populations adjacent to the pipeline. Casual observation has revealed that ocean currents carry the sediment and redeposit it at various distances, depending upon the particle size of the sediment. Moreover, these same factors along with the rate of burial operation determine the length of time in suspension.

As previously mentioned (Sec. I.A.), the expected length of pipeline from this proposed sale is 161-282 km. Locations of these pipelines are presently unknown. We expect that the area impacted would be localized within 50 m of the particular operations throughout the water column. However, this area may decrease or increase because of the following variables: water currents, sea conditions, water depths, natural bottom sediment, and dispersion rate of bottom sediments from jetting operation.

Recovery rates would be dependent upon seasonal reproduction cycles and recolonization by indigenous and other species. Estimates for recolonization range from months to several years.

There are two tracts of this proposed sale, tracts 45-50 (High Island Area, East Addition, South Extension) and 45-55 (High Island Area, South Addition) which are located on or near areas of high biological productivity or significance: East Flower Garden Bank and Stetson Bank, respectively. Stipulations on these tracts, as provided in Section IV.D., will ensure that measures are taken to protect these banks from damage.

Thus it is believed that while drilling activities will have a severe effect on benthic organisms in the immediate vicinity of the activities, the overall impact on the benthos from this proposed sale will not be of any wide spread or long term significance, nor will the cumulative impact of previous and future sales be of any significance.

5. Impact on Shorelines

Beaches

The activity which would affect sandy beaches in the proposed sale area, other than a major oil spill (see Section III.A.5.), may occur in the transportation phase of oil and gas operations. If pipelines in addition to those already in place, are needed to transport production, then a beach crossing may be necessary.

As a pipeline approaches the beach, there is a transition from burial by jetting to burial by dredge, either bucket, clamshell, or suction dredge. As this operation crosses the beach, it will disrupt and rework the sand for a width of 10 to 15 m, possibly killing the indigenuous beach fauna. At least one year will be required for the disturbed intertidal zone to return to normal.

Above the high-tide line, devegetation will occur along the pipeline right-of-way. Small dunes appear to recover within a few years after the installation of pipelines. Large, primary dunes will require much more time. These processes of dune reconstruction can be accelerated by planting of dune vegetation, such that dune communities can be expected to recover within a few years to soil, plant and animal conditions similar to an undisturbed, small dune (Willingham, et al., 1975).

Estuaries

The estuaries of Louisiana and Texas are highly productive ecosystems. Detrimental effects upon the primary productivity of these ecosystems would result in a decrease in the planktonic food supply of the menhaden, shrimp, and other fisheries in addition to direct toxic effects of crude petroleum on other fauna and flora. Ketchum (1973) cautions that while effects of petroleum depend upon proximity to and type of oil released, "Any release of oil into the environment carries a threat of destruction and constitutes a danger to world fisheries".

However, other authors believe the adverse effects of petroleum hydrocarbons on the biotic communities of the Gulf Coast are less significant. St. Amant (1973), speaking of the oil producing structures in the bays, offshore areas, estuaries and marshes of his state says:

> "Louisiana's coastal areas with more than 25,000 producing wells, with some fields that have been in production for more than 40 years, and most of which has existed for 20 years, serves as a type area of high production and long-term pollution."
>
> Yet St. Amant, aware of possible environmental damage which may result from ". . . chronic mismanagement of the environment . . .", states:

"Long-term exposure in Louisiana does not seem to have resulted in significant changes in the biotic productivity of the marine system and the presence of normally occurring hydrocarbons at levels of from 100 to 500 ppm. in bottom mud tend to confuse attempts to determine accumulative levels of petroleum hydrocarbons in the substrate.''

While studies cited previously in this section indicate the retarding effect of petroleum on primary productivity, it is St. Amant's opinion based on his experience that there has been no decrease in overall productivity in Louisiana resulting from introduction of crude oils into the ecosystem (St. Amant, 1973).

The presence of oil consuming microbes which consume limited amounts of hydrocarbons as documented for Barataria Bay, Louisiana (Stone, 1972) may partially account for the reported lack of environmental damage.

Onuf (1973) studied the effects of petroleum in the field near refinery effluents, natural seeps and drilling operations and in the laboratory. He cites a study of Spears (1971) in which the biological effects of oil production upon estuarine organisms were considered. In the study, Spears compared the yield of harvestable organisms from waters receiving oil field wastes in Texas with nearby waters which were relatively unaffected by human activity and concluded that there was a serious detrimental effect to commercially important organisms due to oil field wastes. However, the high concentration of oil in the creek under study (16 ppm) and the effects of brine effluents concludes that ". . . demonstrable effects of long term pollution by oil are very local and often associated with concentrations that approach acutely toxic levels. Where more general effects have been suggested, confounding factors have not been satisfactorily discriminated''. According to Onuf:

> "The fact that a long period of large scale oil extracting activities has not reduced the productivity of major fisheries along the Gulf Coast of Louisiana suggests that many populations in offshore regions can accommodate long term, low level intrusions of oil. The case for estuaries cannot be so succinctly stated nor dismissed. No respectable field experiments (on estuaries have been reported.''

Onuf points out that lab experiments have revealed "...dislocations of normal behavior..." by organisms in concentrations of oil found in some polluted estuaries and that adverse synergistic interactions between low concentrations of oil and temperature/salinity stresses are of such dangerous magnitude that they warrant direct testing by field experiments. He feels that refinery effluents cause more environmental harm than drilling operations, although he maintains that no predictions are possible on how serious the damage may be.

Galtsoff (1959) noted that the major effects of industrial wastes and the soluble components of crude oil on oysters is a reduction in the rate of various physiological functions, principally ventilation of the gills. Specifically, these pollutants cause a reduction in the amount of time during which an oyster opens its valves for feeding and respiration, and also interferes with the coordination of the ciliary motion with the result that the pumping capacity of the gills is reduced. The reduction in feeding time (simultaneous with respiration) results in a lowered growth rate and poorer quality oyster meats. It is well known that oysters can become contaminated with oil. (Ehrhardt, 1972; Galtsoff, op. cit.; Mackin and Sparks, 1962) but there is still scientific debate as to whether oysters can cleanse themselves when returned to clean water.

Teal and Stegeman (1973) exposed two oyster populations, differing in fat (lipid) content, to oil and found that petroleum hydrocarbons were accumulated by both groups of oysters. The oysters with a higher lipid content collected the greater wet weight of hydrocarbons, although the two populations were similar to clean water, the hydrocarbon content was rapidly, though incompletely, discharged. These researchers also found that the petroleum contained in the oysters differed from the contaminating oil by showing a greater percentage of aromatics. This result suggested that a higher percentage of aromatic fractions of oil were more likely to be incorporated into the oyster's tissue. The possibility that the oysters were themselves modifying the oil could not be discounted, however.

In summary, while current research indicates the potential hazards of chronic hydrocarbon addition to the estuarine environment, field observations in Louisiana do not indicate that chronic pollution has reduced overall productivity. Should this proposed sale be held it is possible that oil spills which could result from exploration development and transportation of petroleum from leased tracts may have some adverse affect on the estuarine areas of Louisiana and Texas.

Wetlands

The transportation phase of development will affect the wetlands in the proposed area if the need for pipelines arises and the pipeline right-of-way crosses this ecosystem type. However, as noted in Section I.A., no additional pipeline landfalls are expected to result from this proposed sale.

There are two basic methods of traversing wetlands with a pipeline.

The "push" or "shove" technique is possible only where the marsh is firm. In this technique, a narrow, relatively shallow ditch is excavated by a dragline or clamshell digger from the bank. By using a marsh buggy base or by using runners or pads to spread the weight, the damage to the bank is minimized. The ditch may be 1 to 2 m deep by 2 to 3 m wide. The pipe sections are joined together at the point of origin of the ditch, the line given temporary buoyancy by strapped floats, and pushed or shoved down the ditch. A section as much as 24 km long can be installed in this fashion. After being floated into place the floats are removed and the line allowed to sink to the bottom of the ditch. Typically, there will be approximately 1 m of water above the pipe. The ditch may be left open but is more frequently backfilled. Even with firm marsh soils, there is generally sufficient subsidence and shrinkage that the spoil will not completely fill the ditch. However, there usually is no canal after completion. The shove technique is less costly than using flotation barges, and is preferred where possible.

The second method of pipe laying utilizes a flotation canal to provide access for the pipe-laying equipment. Such a canal may be 12 to 15 m wide and 2 m deep, and may have an additional trench in the bottom to provide 3 to 4 m clearance above the top of the pipeline.

The pipeline is constructed on a series of lay barges, and passed over the stern of the train. The pipe is large and heavy, and massive equipment is needed to manipulate it. For example, a standard 12 m section of 1 m diameter pipe weighs approximately 3,629 kg. After the addition of a corrosion coating and 76 to 102 mm of concrete to give it negative buoyancy, a 12 m section weighs about 15,422 kg. Equipment to handle weights of this magnitude cannot be supported by the marsh.

This type of canal is excavated by a flotation dredge, which normally piles the dredged spoil upon each side to form a low levee. Characteristically, where this type of canal is utilized, the marshes are soft and unstable, sometimes to the point of being near-floating marshes.

Generally, the dredged spoil is piled back some distance from the canal to leave a 9 to 12m berm between the canal and the levee. The levees are characteristically low and flat. Depending upon the width and depth of the canal (which determines the quantity of the spoil) and on its stability, a levee may be 1 to 2 m high and possess a base width of 15 to 30 m. The high water content (50-80%) and the organic nature of the excavated spoil results in major shrinkage and subsidence when piled on top of marshland with similar properties. Height reductions of 50% are possible.

Because of these factors, there are never enough dredge spoil from the excavation to backfill a flotation canal. Where canals traverse State-owned land or wildlife refuges very stringent conditions may be attached to the right-of-way grant with the objective of minimizing impact on the land, and these may include backfilling a flotation canal. In one recent example, nearly 3 km of flotation canal crossing a wildlife refuge were backfilled. However, as usual there was insufficient spoil material, and additional backfill (nearly 160,000 cubic yards) had to be dredged from a nearby bayou and lake. Backfilling with foreign material on a large scale is probably economically unfeasible, and the environmental impacts of the extensive addition dredging that would be required are unknown but probably are significant.

In the course of laying such a line through marshland, numerous bodies of open water will also be traversed. The same equipment may be used, although only a trench will be dredged, or the assembled line can be jetted into place. Hydraulic dredge spoil may be pumped to nearby land, dispersed over the nearby area, or piled up in spoil islands, depending on the particular situation.

Treatment of completed canals, whether "push" or "flotation" is a matter of negotiation between the pipeline owner and the owner of the land being traversed. Land owners may require bulkheads or plugs or dams wherever a canal intersects another waterway, in order to minimize erosion and to prevent navigation traffic, which is a prime cause of erosion.

As with any major engineering effort there are a number of actions and effects from the general pipeline construction operations irrespective of the type of canal constructed. Either type requires surveying and an alignment established and marked. Marsh buggies have normally been used for this operation; these may have a permanent effect on the marshes, especially some softer ones. Even though wide tracts are used, and the unit pressure on the soil is low, the weak marsh structure is compressed, and depressed tracks are left. These may not be self-repairing in some cases because of their depth, and may act as erosion foci.

Similarly, when back-supported draglines are used to dredge push canals, the berm may be damaged, even when pads are used, if the marsh is soft.

In the construction of a flotation canal and laying of a pipeline, there also can be erosion effects upon the canal from the ancillary boat traffic bringing men and materials to the site but this is a short term effect.

Gagliano (1972) has identified several adverse impacts to marshes as a result of pipeline canal dredging. They include primarily the disruption of marsh vegetation, altered water flow patterns, salt-water intrusion, accelerated runoff and increased tidal exchange. Altered water flow and salt-water intrusion are considered to have the most severe long term effects on wetlands. The affected states, which control the location and construction of pipelines onshore, have the major responsibility for protecting coastal zone areas from pipeline related impacts. Any of these impacts have the potential to reduce a marsh's productivity or alter the floral and faunal components. The duration can be expected to be short-term (less than one year) if the area is rehabilitated upon completion of the pipeline. However, impacts could result for seveal years if no effort at reclamation is made.

Generally, it is advantageous for industry to utilize existing pipelines whenever possible in order to reduce expenses and also to eliminate unneeded disturbances of resources. From the estimated 20-35 platforms that may be generated as a result of this proposed sale it is estimated by USGS that a maximum of 282 km of pipeline may be required. It is anticipated that production from this sale proposal will be connected to existing facilities and the probability of pipelines coming ashore is remote. Therefore, it is thought that no adverse impacts resulting from transportation of crude oil or gas, storing, and refining activities would be incurred to marshes, either immediately or cumulatively, should this proposed sale proceed.

6. Impact on Reefal Structures

BLM has proposed that tract 50 of this proposed sale be offered with the protective invironmental stipulation in Section IV.D. The stipulation provides the areas in which pipelines, rigs, platforms, and any other development operations may be located; it gives the type of disposal for drilling operations; and it assesses impact of drilling operations. It also directs the lessee to conduct a monitoring study to assess the impact of operations for the stipulated area. See Figure III-2.

This stipulation has proved to be adequate for the Flower Garden based on results of studies conducted by Bright, et al., (1976) and Mobil (1975). The following was taken from Bright, et al., (1976): Comparison of observations made by Texas A & M in 1974 (before drilling) and 1975 (shortly after drilling of two holes) on southeast transects from the main coral reef out to the edge of the bank and into the Soft Bottom Zone indicates no apparent effects of drilling on any of the conspicuous epifauna or groundfish populations. No evidence of recent mortality which could be reasonably attributed to drilling and no signs of undue sedimentation on the bank which may have been associated with the operation were observed. The nature and "health" of the biota within the Algal-Sponge and Antipatharian Zones appeared nearly identical from one year to the next on the basis of observations made by the same personnel, television documentation and color photography. The diversity, distribution and abundance of epifauna and fishes did not differ to an extent which seemed to indicate population changes in the area.

We feel that these stipulations are adequate for protection of these banks and reefs from direct adverse impact. However, the potential for long-term, indirect impact from drilling and production operations on such features as reefs and banks is insufficiently known to allow prediction at this time.

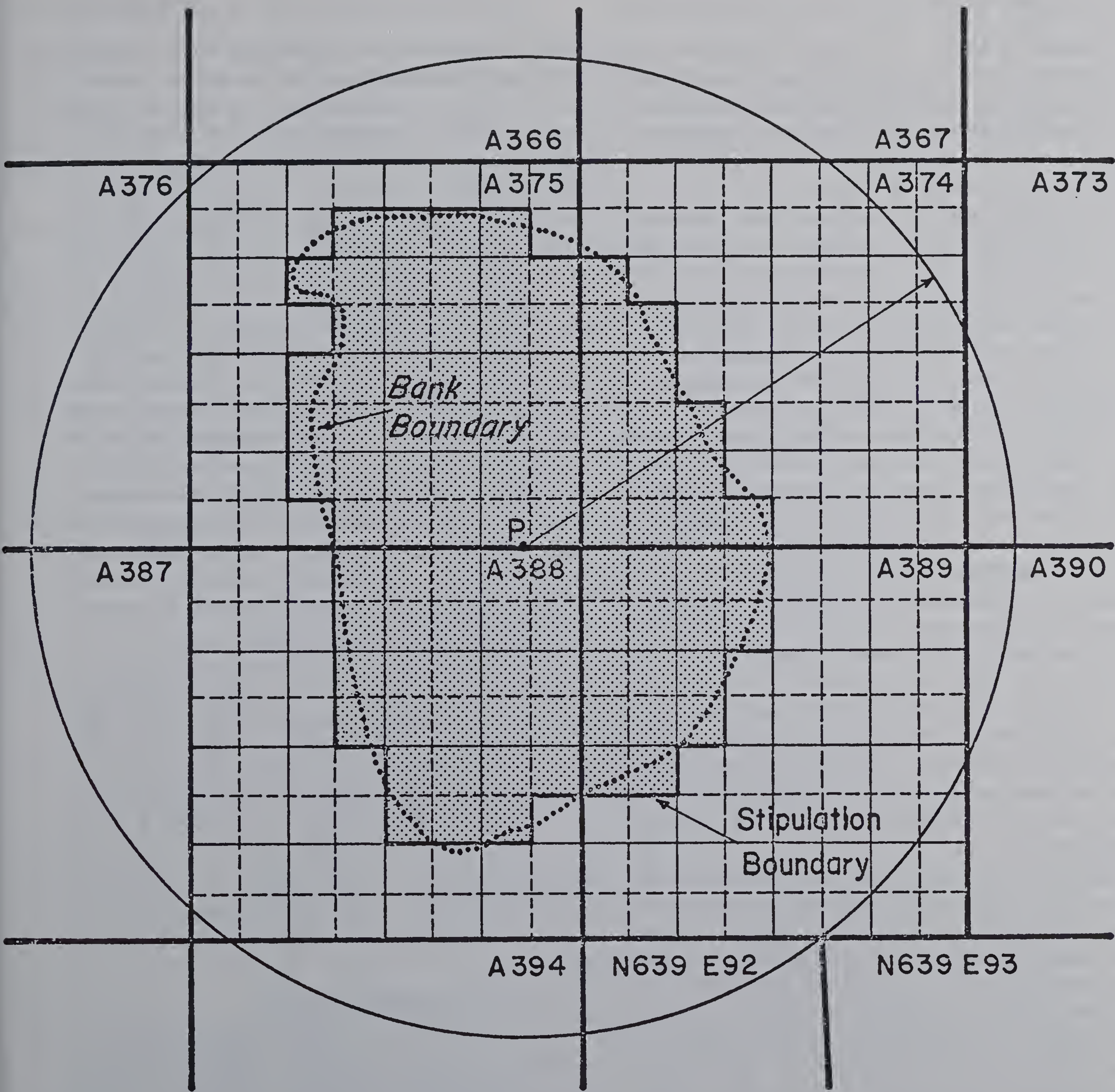


Figure III-2 East Flower Garden Bank, located in the High Island Area, East Addition, South Extension. Reef building coral are located within the shaded area, and according to Stipulation No. 3 (see Section IV.D.) no development activities (such as drilling, structures, and pipelines) would be permitted within this area. Stipulation No. 3 would also require shunting and monitoring on all operations which take place outside of this area but within the circle (with radius of 20,064 feet around point P at X = 3,742,875, Y = 71,280; Texas Lambert System). The stipulation will not apply to operations outside the circle. Block A374 is proposed for leasing in this sale.

7. Impact on Birds

Bird kills were reported following the Torrey Canyon spill in southwest England (Smith, 1968); the Santa Barbara spill, California (Straughan, 1971); and the San Francisco Bay spill, California (Chan, 1973). Causes of death include: 1) disruption of feather surfaces leading to either drowning as a result of the loss of buoyancy, or pneumonia as a result of the loss of thermal insulation; 2) ingestion of toxic oil droplets from excessive preening; and 3) ''accelerated starvation'' as a result of increased metabolic activity (to compensate for loss of body heat) coupled with a decrease in feeding (Boesch et al., 1974).

Diving ducks and pelicans that dive into water to collect food are more susceptible of contacting oil slicks. These species are usually gregarious, and there could be a potential for small local populations to be lost as a group.

As no additional onshore development is predicted to result from this proposal (Section 1) there should not be any adverse impacts to endangered bird species as a result of onshore construction.

The proposed tracts located offshore from critical habitat for the endangered whooping crane, peregrine falcon, and Attwater's prairie chicken, are indicated to be gas prone (Appendix A) and therefore have a minimal potential oil spill risk (Appendix D).

Six proposed tracts (85-88, 109 and 110) present a potential maximum impact and three tracts (95, 96, and 108) present a potential moderate impact for oil contamination of food species near bald eagle nesting areas (Visual No. 4 - Appendix D).

West Delta Block 33 (Tract 109) is an oil and gas prone tract located about 16 km southeast of the brown pelican nesting area on Queen Bess and Grand Terre Islands, the only brown pelican nesting area in Louisiana. This tract presents a maximal potential impact from oil contamination of the habitat and food of as well as individual brown pelicans. Brown pelicans could be coated with oil while diving for food fish, if any oil spills occur within their feeding range.

There should not be an adverse impact on the sandhill crane as a result of this proposal as no onshore development is predicted and the nearest oil prone tract to the crane's habitat is about 88 km.

Adverse impacts on shore birds (plovers, gulls, etc.), pelagic birds (terns, shearwaters, etc.) can take several forms: 1) destruction of nesting habitats; 2) destruction or contamination of food; and 3) direct mortality from ingesting or being coated with oil. Therefore, all of the proposed oil prone tracts (Appendix A) would present some degree of impact. Nine tracts (85-88, 101, 109-111, and 116) present a maximal potential impact and eight tracts (95, 96, 102, 108, and 112-115) present a moderate potential impact of oil spills contaminating the habitat, food, or individuals of these species. These tracts are listed in Appendix A as gas and oil prone tracts. Therefore the possibility exists of a possible oil spill occurring if oil production proceeds in these tracts. These tracts are located from 5 to 19 km offshore. If an oil spill should occur and drift shoreward there is a possibility of oil contamination of bird habitat, food sources, and individual birds diving into oil slicks while feeding. These tract locations are keyed to the matrix analysis (Appendix D) and Visual No. 4 to indicate the potential impact of each tract to these bird species.

In summary the major impact on birds as a result of this proposal will be as the result of oil spills on diving species which become coated with oil and expire. Proposed tracts 85-88, 101, 109-111, and 116 may present a maximal potential impact on these bird species. Past (and proposed future) oil and gas development in the Gulf of Mexico region has had (and will have) an adverse cumulative impact on bird species as a result of habitat destruction from onshore construction and oil contamination of food species and individual birds.

8. Impact on Marine Mammals

Fifteen species of cetaceans (Section II.E.6.) including six endangered species (black right, humpback, fin, sperm, sei and blue whales) have been sighted in recent times in the Gulf of Mexico. The bottlenose and spotted dolphin are the most common small cetaceans, the sperm and short-finned pilot whales are the most common larger cetaceans in the proposed sale area. There is, however, little information on the population dynamics of cetaceans in the area. While many cetaceans commonly travel in groups, limited data on regional occurrences may indicate that only individuals would be impacted by oil spills as a result of the proposed sale. However, if this reduction were to occur to a threatened population this could result in serious depletion of the species. Since marine mammals have an impervious skin and breathe air, opportunities for toxic components of oil or emulsifiers to exert a physiological effect are largely limited to their ingestion. As cetaceans forage for such organisms as copepods, euphasiids and fish, localized decreases or redistributions of these organisms as a result of OCS activity could limit food availability for cetaceans. Ingestion of contaminated organisms as a result of an oil spill incident could occur. While nursing cetaceans might ingest oil, other effects of hydrocarbons upon mating, implantation, pregnancy, placentation, and parturition are unknown for cetaceans.

There is evidence to indicate that heavy metals are accumulated in the marine food web in a variety of organisms at various trophic levels and through a variety of paths of uptake. Most of the characteristics of heavy metals favor magnification in the food web. Therefore, the possibility is present that marine mammals could ingest heavy metals that could result in an accumulation of these substances in the lipids of the organism.

Irritation of the eyes or exposed mucuous membranes may also be common to petroleum contaminated individuals. A potential danger to cetaceans is the absorption of hydrocarbons through or on the mucus membrane lining of the blow hole. This area remains open near the water surface and may become oiled. The ultimate outcome of oil exposure could be a thin oil film covering of the lungs and respiratory passages which has the same effects as pneumonia. In this case it would be unlikely that the oil would be identified as the causative agent.

Data are not available in the Gulf of Mexico to estimate the impact of offshore production on marine mammals. However, the impact would appear to be a function of the probability of an oil spill and the population size and distribution of the species. For marine mammal populations such as the bottlenosed and spotted dolphins or the short finned pilot whale there is little probability that their population would be affected.

However, in the case of endangered species of marine mammals, any contamination by oil of an individual and the subsequent harm incurred would be detrimental to the population of that species.

9. Impact on Marine Turtles

Two endangered species of marine turtles (the Atlantic Ridley and Leatherback) and two threatened species (the Loggerhead and Green) inhabit the Northern Gulf of Mexico (USFWS, 1976).

Adult Loggerheads seem to be attracted to "treelike" platforms offshore. Ogren (1976) has observed them sleeping under offshore platforms off Panama City, Florida. Mr. Charles Diaz, NMFS Special Agent, Houston, reports that skin divers spear them. They probably use the platforms for feeding and resting areas. Turtles in the vicinity of platforms would be vulnerable to both oil spills and possible collision with boats.

Some mortality could be expected should spills reach nesting beaches. The nesting season usually lasts from late spring through summer. Hatchlings emerge after an incubation period of about two months. Eggs or hatchlings could be oiled during this prolonged period, plus approximately two months following the last turtle nesting. Death of eggs also could occur through asphyxiation of embryos without oil contacting the eggs should the sand be covered with oil. They could also be vulnerable to predation due to habits of predators.

Hatchlings are disoriented by lights according to McFarlane (1963). Lights on the beach or at sea can affect turtles in their post-natal drive to each open water and favorable currents. Therefore, refineries, docks, offshore platforms and gas flaring would be expected to disorient or attract the hatchlings. Turtle hatchlings are especially susceptible to oiling during the first six to nine months of development while they are pelagic in habits and prior to moving inshore to take up benthic habits (except the Leatherback). During this period, they are frequently observed associated with mats of sargassum weed (Smith, 1968; Caldwell, 1969). Passive transport by ocean currents is the main dispersal mechanism for these turtles and is the same type of movement expected of oil spilled in the offshore area. Turtles surface at one to three minute intervals when actively swimming and at least 30-40 minute intervals when resting. They are, therefore, very vulnerable to oiling during an oil spill in their vicinity.

The population dynamics of marine turtles and the impact of oil and gas operations on their habitat have not been studied and therefore are difficult to evaluate. However, the endangered and/or threatened species status is an indication that any unnatural loss of marine turtles should not be permitted.

Visual No. 4 (Western-Central Gulf) indicates that Loggerhead turtle nesting occurs on the Chandeleur Islands. Proposed lease tract 116 is located approximately 13 km SE of Chandeleur Island and the matrix analysis indicates this tract has a potential for maximal impact. Should an oil spill occur from this tract the probability of impacting marine turtles nesting on Chandeleur Island would be very high. The cumulative impact of past and proposed future oil and gas lease sales on marine turtles is a negative impact to an unknown degree.

10. Impact on Other Wildlife

There probably will not be a direct negative impact on the endangered red wolf population in southeast Texas and southwest Louisiana (Visual No. 4) as a result of this proposed sale. No additional onshore construction is predicted (Section I.) and the proposed offshore tracts in this area are all gas prone (Appendix A). The matrix analysis (Appendix D) indicates a minimal potential impact from these proposed offshore tracts. It is estimated that the highest concentration of American alligators in the central Gulf of Mexico occurs in the freshwater coastal marshes and swamps of southwestern Louisiana. Alligators are seldom found in marshes where water salinity exceeds 10 ppt. Therefore, saltwater intrusion caused by onshore construction (dredging for roads, canals, etc.) will result in the loss of alligator habitat. The ingestion of oil coated food (nutria, waterfowl, etc.) by alligators is probable, though possible ill effects have not been determined.

No additional onshore construction is predicted within this coastal marsh region as a result of this proposed sale (Section I.). The matrix analysis (Appendix D) indicates that 17 tracts (66, 70, 89, 95–99, 102, 103, 108, 112–114, 117, and 120) may have a moderate potential impact and 10 tracts (85–88, 101, 104, 109–110, 111, and 116) may have a maximal potential impact on the habitat and food species of the alligator and probably on the alligator population.

There could be an indirect negative impact on the small population of marsh white-tailed deer which inhabit the Mississippi delta marshes from any habitat encroachment or destruction. The matrix analysis indicates five tracts (108 and 112–115) may have a moderate potential impact and three tracts (109–111) may have a maximal potential impact on the marsh habitat of the deer, if any oil spill should wash onshore or if an onshore pipeline leaked petroleum hydrocarbons.

The possible impacts on furbearers (nutria, muskrat, and raccoon) in the central Gulf of Mexico coastal marshes would be similar to those of the American alligator. An oil spill could result in the loss of marsh habitat, food species (vegetation, crustaceans, etc.) and to the furbearer population. The insulating properties of the fur would be destroyed upon coating with oil and could result in illness or death of these species.

In conclusion the major impacts on other wildlife species as a result of this proposal will be two pronged. An indirect adverse impact to species populations as a result of possible habitat and food loss and a direct impact to individuals which succumb as a result of ingesting or being coated with petroleum hydrocarbons.

Also indirect cumulative impacts to these wildlife species have occurred and will continue to occur from past and proposed future OCS oil and gas operations as a result of coastal habitat encroachment and destruction. The amount of this specific habitat destruction is difficult to quantify.

11. Impact on Commercial Fisheries

Offshore oil and gas operations impact commercial fisheries in the following ways: removal of sea floor from use; underwater obstructions; oil pollution (chronic or accidental); pipelines; and reefs.

Since the majority of shrimp and commercial bottom fish are caught by dragging large trawls across the sea floor, sites occupied by drilling or production platforms and attendant service boats and barges must be avoided. If the structure are jack-up drilling rigs or permanent production platforms, the area of the sea floor removed would amount to one to two hectares for each structure. In deeper waters (over 91 meters) a semisubmersible drilling rigs with its anchoring system would occupy from 66 to 92 ha (assuming 457 to 637 m anchoring radius). Trawling depths range from approximately 9 to 91 m; therefore, structure positioned beyond the 91 m depth would have a minimal impact on trawling operations. The duration of exploratory drilling ranges from approximately 45 days for a single well to around 6 months for multiple well explorations. Permanent production platforms may remain in place for 10 to over 20 years.

The probability that permanent platforms will be erected on any leased tract, based on past exploration success rates, is about 32% for offshore Louisiana.

Approximately one out of three tracts will require a platform (or platforms). It is estimated that each full tract (2,331 or 2,023 hectares) developed will average two platforms. Using the actual dimensions of a platform, two per tract would physically cover approximately 0.02% (0.4 hectares) of each tract's sea floor. Taking into account a navigational safety zone around each structure and using the one to two hectares per platform figures, trawlers may be denied up to 0.2% (four hectares) of the sea floor per developed tract assuming two platforms are erected. The number of new platforms expected from this sale ranges between 20 and 40, therefore, the maximum area denied fishermen would be 160 hectares for the duration the platforms are in place.

There exists the possibility of fishing boats colliding with structures. A Coast Guard summary for the period July 1, 1962 through June 30, 1973 reported ten collisions of fishing boats with offshore structures. Causes of these collisions were personal neglect aboard fishing boat (5), equipment failure on boat (1), equipment failure on rig (3), and insuffìcent and improper lighting of rig (1). There was only one injury; total damage to boats amounted to $151,000 and damage to platforms $24,000.

It is obvious that commercial trawling may be adversely affected to some degree for the next few years because of reduction in trawable grounds; however, the extent of this is not known but will be more cumulative in nature. There are no data to indicate that offshore exploration is responsible for any decline in catches at present. There is reason to expect that with an increase in the number of platforms, the chance for increased fishing boat collisions with these platforms will result; however, this is unquantifiable.

Underwater obstructions may cause problems to trawlers. The obstructions referred to here are submerged well heads, underwater stubs, and large pieces of debris which when snagged, may cause damage to trawl nets.

As previously stated, Coast Guard regulations require that stubs be marked by a lighted buoy at the surface if there is less than 26 m of clearance. Stubs with clearance of between 26 and 61 meters must be buoyed; however, a lighted buoy is not required. These buoys are frequently missing despite regular maintenance and replacement. Also, in water depths of 26 to 61 m, if the stub is covered by a bonnet, then it need not be marked by a buoy.

Another safeguard has been the plotting of these stubs on navigation charts for vessels with accurate navigational equipment.

Large pieces of debris, such as equipment, piping, structural members, tools and the like, may accidently be lost off a platform, service boat or barge. If this occurs near a platform it may be located by divers and retrieved as specified in OCS Order No. 8. However, if it is lost from a boat or barge underway, the location may not be known accurately enough to allow its subsequent recovery.

Dr. J. T. Thompson, investigating for the Gulf Universities Research Consortium (1974) found no evidence to indicate either harmful or beneficial effects of the placement and maintenance of offshore oil platforms on the bottom fisheries on the open shelf. His study included: croaker, spot, scup, cutlass fish, sea catfish, sea trout, ground mullet, lizard fish, blue crabs, and brown and rock shrimp. The period (1950–1965) saw the rise of the offshore oil industry in the study area. Dr. Thompson stated that no trends were apparent in either quantity or distribution of species studied.

Oil spills could have both short- and long-term impacts on commercial fisheries; however, no measurable effects have been observed for chronic or accidental spills of oil. Oil spills may physically prevent fishing in contaminated areas. Adult finfish are not normally killed outright, but possibly could suffer a long-term decline due to lowered resistance to disease and environmental stress. Larval and juvenile fish could be killed in great numbers if a spill reached spawning or nursery grounds. Many fish not destroyed may be tainted with hydrocarbons and be unmarketable. Shellfish are more susceptible to contamination because of their inability to escape and their general filter feeding habits. Many larvae and juveniles could be killed outright. Survivors could be tainted and unmarketable for long periods.

Presently under development by National Ocean Survey and BLM is a program to chart all major offshore pipelines and flow lines. Several charts for regions of the Gulf of Mexico have now been issued.

Platforms are sites of marked increase in biomass due to the "reef effect," over one to two orders of magnitude higher than other biotopes (Table III-7). Components of this increase are the fouling community and the fish they attract which are responsible for this portion of the economically important sports and commercial fishery.

Commercial trawlers would probably be effected by this proposed sale, by the reduction of the trawling area. The effect that this would have on catch is unknown. The majority of these tracts are already located near developed areas. Therefore, this area is probably not extensively trawled. Underwater obstructions and pipelines would also effect trawling operations. The pipelines that are anticipated to result from this proposed sale would be tie lines to a main line. These lines would also be in a developed area as well as being buried to 0.9 m below the mud line out to a water depth of 61 m.

Several tracts that have an oil potential are located near shore. If an oil spill resulted there is a possibility that the oil could enter estuaries. If this were to occur during spawning this could result in death of the larvae in that particular area. However, since the range of these fish are Gulf wide, the total impact on the species would be minimal.

The cumulative effects of this proposed sale would be minimal in view of the present production rate in the Gulf of Mexico.

12. Impact on the Marine Food Web

a. Biogenic and Petroleum Hydrocarbons (PHC)

Marine organisms synthesize hydrocarbons under natural conditions. Biogenic hydrocarbons important to organisms may be identical or similar to petroleum hydrocarbons. However, crude oil consists of molecules of different size in even distribution and crudes are rich in toxic aromatic hydrocarbons and cycloparaffins and contain isoprenoid hydrocarbons and are devoid of olefins and alkenes.

1) Saturated hydrocarbons, alkenes and paraffins occur naturally in marine organisms. When found in PHC they may cause anaesthesis, narcosis, or they may interfere directly with the reception of chemical cues. All of these effects interfere with feeding, nutrition, and communication between aquatic organisms.

2) Unsaturated hydrocarbons. Biogenic alkenes are found in aquatic organisms and may serve in biochemical communications. Alkenes are rarely present in crude oils, but when present are found in trace amounts.

3) Biogenic alicyclic hydrocarbons are present in several herbs and land plants.

4) Aromatic hydrocarbons. While it is not known if biogenic boiling aromatics are found in marine organisms, these organisms synthesize higher boiling aromatics. Petroleum aromatics have been reported as the most toxic of the hydrocarbons.

5) Non-hydrocarbon compounds in petroleum. These compounds include cresols, xylenols, naphols, quinoline, pyridines, and hydroxybenzoquinolines.

b. Uptake of Petroleum Hydrocarbons

Hydrocarbons are available to marine organisms in different physical and chemical forms which influence uptake by organisms. Although petroleum is a hydrophobic mixture of compounds, it can eventually be present to pelagic organisms as dissolved, dispersed, or as suspended or floating tar lumps of various sizes. Benthic organisms are also exposed to petroleum in the sediments. Birds, however, are exposed to PHC while it forms a slick.

PHC may enter the food web by ingestion of contaminated particles, prey, or water in addition to uptake through the gills or body surface with varied adverse consequences. Dissolved PHC were taken up by the gill tissues of *Mytilus edulis* while marine finfish have taken PHC up through the gills. Tissue damage resulting from exposure to PHC includes sloughing of epithelium and a typical basal cell hyperplasma of the ciliated inner gills of quahogs. Mollusks and barnacles may isolate themselves from excessive amounts of PHC through shell closure for temporary protection. In copepods, PHC was assimulated by the gut, passed through the organisms, and was eliminated as feces, a significant fact because oil from a slick can be grazed by the copepods. However, fecal pellets can be eaten by other members of the food web. PHC maybe taken up and accumulated, at least temporarily, within body tissues of

Table III-7. Comparison of Biomass at Three Locations

	Timbalier Bay	Platform 54A	Offshore Control
Organic Carbon in water	8.3-14.5 gm/m^3	5.8 gms/m^3	5.1 gm/m^3
Hydrocarbons in water 1/	6.2 mg/m^3	3.3 mg/m^3	1.2 mg/m^3
Hydrocarbons in surface film	not studied	0.21-1.27 mg/100 grams	0.12-1.27 mg/100 grams
Hydrocarbons in sediments	161-341 mg/100 grams	145-412 mg/100 grams	145-412 mg/100 grams
Primary Productivity	not studied	1.07 gms/m 2//day	1.03 gms/m 2//day
Amphipods	8.75 gm/m 2/	24.2 gm/m 2/	17.7 gm/m 2/
Zooplankton	0.02-0.2 gm/m^3	0.3 gm/m^3	0.3 gm/m^3
Polychaetes	0.3-5.0 gm/m 2/	not studied	N.A.
Platform growth	N.A. 3/	3000 gms/m 2/ pile surface	N.A.

1/ Hydrocarbons from all sources, including petroleum, organic detritus, plankton, etc.

2/ Substantially higher offshore Louisiana than other regions investigated in the open Gulf and offshore Florida.

3/ N.A. - Not Applicable.

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many fishes and invertebrates from areas of chronic, low level PHC contamination as well as from areas subjected to an oil spill.

c. Storage and Metabolism

Researchers have demonstrated that PHC concentrate in certain organs and are associated with the lipid content of the body. Work on coho Salmon indicates that the complex lipoproteins of plasma membranes and organelle membranes of all tissues are possible storage sites.

PHC are transferred to various organs of marine organisms including: the gall bladder, brain and other neural tissues, liver and heart of fish; the digestive glea of shrimp; the digestive gland or hepatopancreas of brown shrimp; the mantle, digestive gland, adductor muscle, and gonad of scallops; and the muscle and digestive tract of scallops, periwinkles, urchins, and other intertidal benthic organisms. While contaminated organs (liver, gall bladder, nervous system) of fish are discarded prior to human ingestion, thus decreasing human contamination, oysters and other mollusks are eaten in their entirety, thus exposing human consumers to the concentrated contaminants. Rates of metabolism of PHC by organisms depend upon the fraction of oil, species performing the metabolism, and health of the animal. Some species apparently do not metabolize PHC at all.

d. Discharge or Depuration of Hydrocarbons

There may be two forms of PHC accumulation depuration: 1. Short term accumulation with subsequent rapid depuration completely or to background levels within several weeks to 2 months. This is typical of response after an oil spill. 2. Long term PHC burden in tissues without subsequent complete depuration. This is typical of organisms chronically exposed to oil. Aromatics seem to be the primary fraction accumulating in the tissue. Because they apparently have the ability to metabolize hydrocarbons, shrimp, fish, and marine mammals apparently do not retain residual PHC concentration as do mollusks and certain species of zooplankton.

e. Microbial Decomposition

In sediments, chemical degradation of oil can occur. However, such degradation is restricted to the surface layer of the sediments in water shallow enough for ultraviolent light to reach it. This is usually aerobic and its effectiveness decreases with decreasing temperature. While microorganisms can degrade crude oil, particularly the less toxic paraffins, no single species can degrade all the fractions. Thus several different species would have to be present there in order to effect complete microbial degradation.

f. Carcinogenicity

Petroleum has been implicated as a carcinogen. Two types of cancer have been found in soft shell clams during oil spills involving No. 2 and No. 5 diesel oil, and shellfish, although alive after exposure to PHC, may have been unfit for consumption because of a carcinogen (3, 4 benzopyrene) in their bodies. Natural synthesis and metabolism of carcinogenic hydrocarbons by several marine organisms has been reported.

g. Heavy Metals

Heavy metals occur naturally in sea water in relatively low concentrations. Natural sources of oceanic heavy metals are river water, windblown materials from land following the weathering of rocks, and tectonically active ocean floor ridges where heavy metals are emitted in brines. Other sources include sewage discharges, industrial effluents, and atmospheric pollution. Some heavy metals in trace amounts are essential for life while others are toxic to animal and plant life in all measurable amounts. Heavy metals are present in petroleum, formation waters, and drilling fluids in differing amounts and are in turn added to the marine environment. With the possible exclusion of lead, however, it is believed that the heavy metals in marine ecosystems are derived primarily from natural rather than technological sources.

Marine organisms accumulate heavy metals from the water by adsorption across body surfaces and gills or by ingestion of food containing such metals. Food sources can include heavy metals adsorbed onto suspended particles or plankton, compounds which have precipitated into the sediments and which are then ingested by deposit feeders, and compounds or elements concentrated by prey organisms and subsequently eaten by larger organisms. Adsorption of many, but not all, metals can occur on the surface of suspended particulate matter. Uptake by adsorption from sea water through the gills, body surface, or gut wall (from feeding on contaminated prey) is an important entry pathway for these metals. Various parameters affect the rate of this uptake and the final concentration of the metal in tissue. Different groups of marine organisms accumulate and store heavy metals differentially in tissue depending on their ability to regulate the concentration in their body compared to environmental concentration.

Discharge of heavy metals for marine organism can occur by ion exchange across cell membranes of gill and body surfaces, loss by molting of exoskeletons that have concentrations of heavy metals, excretion of such metals into the gut and subsequent excretion in feces and urine.

h. Food Web Magnification

There is increasing evidence that classical food web magnification of petroleum hydrocarbons does not occur. While not considered magnification, the possibility does exist of some selective PHC buildups in the food chain in chronically polluted areas in mollusks which seem to retain a portion of the aromatic PHC.

In contrast to PHC, there is ample evidence to indicate that heavy metals accumulate in the marine food web in a variety of organisms at various trophic levels and through a variety of pathways. Concentrations of metals and food web magnification also seem to take place. A toxic effect on a consumer, including man, can result from feeding on organisms further down in the food web that have concentrated heavy metals. Metals reported in various organisms include mercury, arsenic, cadmium, copper, zinc, chromium, lead, nickel, and silver.

C. Impact on Air Quality

Degradation of offshore air quality will occur in cases of oil spills, oil and gas blowouts, pipeline breaks, and the normal exhaust of platform generators and service vessels.

An average composition (Levorsen, 1967) of natural gas from an onshore field (an offshore field would be similar) in Texas is as follows: methane 92.5%, ethane 4.7%, propane 1.3%, butane 0.8%, and pentane and heavier gases, 0.6% (small amounts of sulfur are usually present).

If a blowout should occur at a gas well and did not burn, the above gases in a comparable ratio would be released into the air. A typical Texas offshore well produces approximately one million cubic feet of gas per day, so a blowout could reasonably be expected to release at least this much gas into the atmosphere. However, if the gas well were burning, combustion would be essentially complete and the emissions would consist almost entirely of carbon dioxide (CO_2), water, and any sulfurous gases would be oxidized to SO_2. It is impossible to predict the probability of this occurrence. Since essentially all of the components of natural gas are non-reactive, there would be little impact whether or not they are burned. Therefore, recovery of this resource for use as a fossil fuel could result in a positive impact in some areas by providing energy by the cleanest source to be utilized, thus helping to alleviate air pollution.

If a blowout at an oil well occurred and released crude oil into the water, the resulting impact would be substantially greater. If the oil does not burn, some of it would evaporate. During the Chevron 1970 spill, it was estimated that approximately 15% of the 30,000 barrels (bbls.) spilled evaporated. At an average density of 310 lb/bbls, this incident would have introduced approximately 1.4 million lbs of hydrocarbons into the air. Some oil spills in the past have resulted in fires, however, the chance of this occurring is minimal. In fact, if this were to occur, emissions from the crude oil would be relatively low in reactive compounds.

A reasonable estimate of the ranges of emission, assuming complete combustion, that an oil well fire could produce per 1,000 bbls burned, might be as follows (Levorsen, 1958): CO_2; 340,000-47,000 lbs., SO_2; 620-4,000 lbs. (SO_2 emission would be less for Gulf of Mexico crude oil, which range from 0.1 to 0.5% sulfur), and NO; 660-10,000. However, combustion of oil would be incomplete, therefore, the emissions would contain a smaller amount of the above compounds, and would include such materials as volatilized petroleum, particulate carbon, carbon monoxide, nitrous oxide, sulphur monoxide, along with other altered or partially oxidized matter. There is no reliable way to predict in advance the relative volumes of each of these possible emissions because it would depend among other things, upon moister content of the air, wind speed, pattern of oil spray from wild wells, number of wells involved, chemical content and physical character of the oil itself, and types of equipment and materials other than oil that might also burn.

Massive spills from wild wells are not the only source of spilled oil. A number of minor spills during the first nine months of 1972 released over 800 barrels of oil. The net result is that a small amount of spilled oil is floating somewhere on the waters of the Gulf of Mexico almost continually. The evaporation of this oil may cause elevated levels of hydrocarbons in the sea breeze coming off the Gulf. At the present time there is no evidence as to the source of these materials.

If there was an increase in natural gas production it would have a positive effect on air quality. Natural gas is a complete burning fuel which does not create particulate matter, virtually no sulfur compounds, and less nitric oxides than any other common fuel.

The exhaust from the large electric generators on the platforms will contain particulates, sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons which would be dispersed by the prevailing winds and rapidly diluted.

Onshore air pollution resulting from offshore production would not be increased as a result of this proposed sale. The major factors that could result in onshore air quality degradation are transportation (usually freight) increases, population increases, and construction of roads, gas processing plants, and refineries. However, no increases of this nature are expected as a result of this proposed sale.

Oil produced as a result of this proposed sale is not expected to create the need for increased refinery capacity and other petrochemical industries. Instead, it may take the place of imported oil or oil that will not be furnished from domestic sources due to declining production or other factors.

In summary air quality will not be severely degraded as a result of this proposed sale. The largest amount of emission offshore would result from oil and gas well blowouts. Emissions from electric generators on the platforms would only add minimal pollutants to the air. Since there will not be any increased refinery development, there will not be any increase in onshore air quality degradation as a result of this proposed sale. For the same reasons, this proposed sale is not expected to have any cumulative effect on air quality due to any future sales that may take place since any such future sales will probably continue the pattern of Gulf of Mexico oil and gas operations of replacing existing production rather than adding to it.

D. Impact on Water Quality

During drilling and oil production the water quality of the Gulf may be altered and degraded in several ways. Many of the chemical and physical factors which will be transferred to the Gulf during various phases of oil production will represent potential hazards of degraded water quality may be found to be insignificant or significantly adverse. The magnitude of these potential hazards should be answered by future research.

On September 15, 1975, the EPA published in the Federal Register (40 CFR 435) a notice of interim effluent limitations guidelines and new performance standards for the offshore segment of oil and gas extraction point source category. The effluent limitation guidelines are concentration based as opposed to a mass per unit production base.

It is indicated that the major source of waste water generated by offshore facilities are produced waters. The major constituents in waste waters resulting from the oil and gas extraction industry are oil and grease, residual chlorine, and floating solids (see Section III.A.1.).

There are two deadline dates with respect to water quality standards. By 1977, municipal sewage treatment plants must have secondary treatment and all industrial sources must have the best practicable control technology for their class and type of discharge. By 1983, the municipal plants must have the best practicable treatment and industry the best available technology economically feasible. For water quality standards, the Act's objective has been interpreted to mean the restoration and maintenance of the chemical, physical, and biological integrity of the nation's water. All offshore and induced onshore facilities that may result from the proposed sale will fall under these stipulations and into these time frames.

Several methods of treatment technology for waste water from produced waters may be employed to achieve final limitations. It is also noted that drilling muds and drill cuttings may be discharged if they are water based and their discharge does not result in free oil on the surface waters. Muds and cuttings that are oil based may not be discharged. Presently a drilling mud report is required when submitting for a Plan and Development Permit from USGS, this covers both water based and oil based muds. The requirement for this can be found in OCS Operating Order No. 7. By 1983 new source performance standards will require no discharge of waste water pollutants into navigable waters for those wastes generated by produced water sources of this subcategory.

Bottom sediments would be put in suspension during exploration and development by emplacement of blowout preventors, drilling platforms, sea-bottom equipment, pipeline burial, and disposal of drilling fluids and cuttings. Pollutants that are entrapped in the bottom sediments would be dispersed into the water column. A turbidity plume may be created. The life and size of this plume depend upon the size, shape, and density of the suspended material, and the turbulence of the water.

The disposal of drilling fluids and cuttings also results in a turbidity plume. It is estimated that in drilling to 10,000 feet approximately 995 tons of drilling muds and 511 yds^3 of cuttings are disposed overboard during 20 days of drilling. The largest turbidity plume observed in the Gulf of Mexico that has resulted from drilling operations was 20 m wide and 800 m long.

While no definite conclusions have been drawn on the manner in which drilling mud chemicals and drill cuttings may contribute to pollution in the marine environment research in this area is currently in progress. Possible pollutant characteristics include: acute toxicity to fish; high immediate dissolved oxygen demand; and high concentrations of organic carbon, total nitrogen, phosphorous solids, chemical oxygen demand and chromium.

The production and discharge of formation waters (oil field brines) has been discussed earlier. Three components or properties of formation waters contribute to water quality degradation when released into the Gulf. These include: entrained liquid hydrocarbons, dissolved mineral salts, and absence of dissolved oxygen.

Within the proposed lease area, the maximum oil production is estimated to be 75-150 million barrels of oil. This would be extracted over a twenty year period. The expected annual production of oil will be from 3.6-9.1 million barrels. Considering the maximum amount of formation water production (0.6 barrels of formation water per barrel of oil produced), approximately 2.2-5.5 million barrels of formation water per year will be produced, providing that all the tracts are leased and developed.

In the Gulf of Mexico many platforms are disposing of treated formation waters where the treatment equipment puts out an effluent less than 25 ppm oil content, but many older platforms are not accomplishing this. Other locations only manage to meet the requirements of OCS Order No. 8, by releasing waters with entrained oil averaging less than 50 ppm. The range of oil concentrations discharged from surveyed production platforms in the Gulf ranged from 6-827 ppm (EPA, 1974).

Due to many factors which will contribute to the physical and chemical characteristics of formation waters, no reliable estimate can be made to the extent of the impact from these waters. The characteristics of formation water can change during the oil production period as more reservoirs are tapped or if accidental leakage occurs between reservoirs. Formation waters may contain significant concentrations of toxic materials; i.e., cyanide, cadmium, chromium, lead and mercury (EPA, 1974). Therefore, it is concluded that formation water present a potential significant hazard which could degrade the water quality and which may have adverse effects on the marine biota. Injection of formation waters into depleted, producing or an unrelated formation could eliminate this effect on water quality.

Water quality could be further degraded as the result of accidental oil spills. Part of this spilled oil would probably be dispersed into the waters of the Gulf where it will be reduced further by microbial degradation and weathering.

It is estimated (USGS, 1976) that from zero to two terminal storage facilities may be constructed onshore as a result of this proposed sale. These facilities could have a slight impact on the water quality in the vicinity. The amount of effluent discharged and the area in which the facility is constructed is a major factor in determining the extent of the impact. These facilities would come under State jurisdiction in regards to effluent discharge. The Water Quality Management Plans (P.L. 92-500) for each respective state (Texas and Louisiana) provide a baseline for the present water quality for each basin. Depending on the location of the terminal facilities mathematical models would be calculated for the particular basin and the water quality of the area can be determined. Since these facilities are located on shore the regulatory power to provide sufficient waste water discharge is regulated by State Water Quality Boards under EPA guidelines.

In summary, offshore water quality is most likely to be affected by drilling fluids and cuttings, accidental oil spills, and resuspension of bottom sediments.

As indicated the turbidity that results from the discharge of drilling fluids and cuttings is localized and its persistency is short. Thus there would be no severe water quality degradation problems resulting from turbidity.

Oil spills present a more serious problem. Yet even in the case of spills and diluting effect of the large volumes of Gulf waters and the microbial degradation of the hydrocarbons will act to reduce the deleterious effects over time. The seriousness of the effects on water quality will depend on the amount of oil spilled and the depth of the water; in shallow waters the oil may become entrapped in the sediments to be released later when the sediments are resuspended during storms. Unfortunately, none of these effects can be quantified, partly due to our lack of precise knowledge of the fates and effects of oil on the environment, and partly because so much depends on the particular circumstances of a spill.

Judging from past experience in the Gulf of Mexico, oil and gas operations on the OCS do not have a significant long term effect on water quality, although the short term effects in the immediate vicinity of operations may be quite severe.

Since the activities resulting from this proposed sale are expected to replace existing operations rather than add to them, no cumulative effects on water quality are expected. Since future sales in the Gulf of Mexico are likely to continue this pattern of replacement, this proposed sale should not contribute to future water quality degradation resulting from sales in the future.

E. Impact on Ship Traffic and Navigation

In the Gulf of Mexico safety fairways have been established for the safe passage of vessels enroute to or from U.S. ports. Consequently, placement of rigs or platforms are prohibited within these fairways. However, ships do not always use these fairways and this increases the possibility of a collision with drilling rigs, permanent platforms or vessels attending these platforms. Impacts which could result include loss of human life, spillage of oil, release of debris, including part of or the entire drilling rig and the ship. The contents of the ship's cargo could pose a serious threat to the environment if it includes toxic materials such as chemicals, crude oil or refinery products.

A marine casualty is defined as any casualty involving a vessel other than a public vessel, if such casualty occurs upon the navigable waters of the U.S., its territories or possessions, or any casualty involving a U.S. vessel, wherever the casualty may occur. Casualties involving commercial vessels must be reported to the U.S. Coast Guard whenever the casualty results in any of the following: actual physical damage to property in excess of $1,500; material damage affecting the seaworthiness or efficiency of a vessel; stranding or grounding; loss of life; or injury causing any person to remain incapacitated for a period in excess of 72 hours, except injury to harbor workers not resulting in death, and not resulting from vessel casualty or vessel equipment casualty.

Eight cases involving collision of vessels of over 1,000 gross tons with fixed structures were reported in the Gulf of Mexico during the period from July 1, 1962 through June 30, 1973. Twenty-two other collisions of vessels less than 1,000 gross tons with fixed structures were reported during this eleven year period. Fifteen of the accidents involved vessels less than 100 gross tons, and the remaining seven vessels ranged between 100 and 650 gross tons. Of the twenty-two accidents, there was no loss of life involved and damage to the rig was insignificant (USGS, 1974).

For the period July 1, 1973 through June 30, 1975, there were 32 collisions of vessels with fixed structures reported. Three collisions involved vessels of over 1,000 gross tons. Thirteen collisions involved vessels from 100 to 1,000 gross tons. Sixteen collisions involved vessels of less than 100 gross tons (U.S. DOT, 1976).

Figure III-3 shows the increase in the number of offshore structures versus the small number of accidents during the period 1965 through 1973 involving these platforms in the Gulf of Mexico. It should be noted that while the number of structures is increasing, the number of accidents involving structures has not increased. The accidents involving small vessels might in some cases be considered self-generating; that is, the fishing vessels could have been near the rigs due to the improved fishing around the structures, and the barges, cargo and passenger vessels could in some cases have been servicing the platforms.

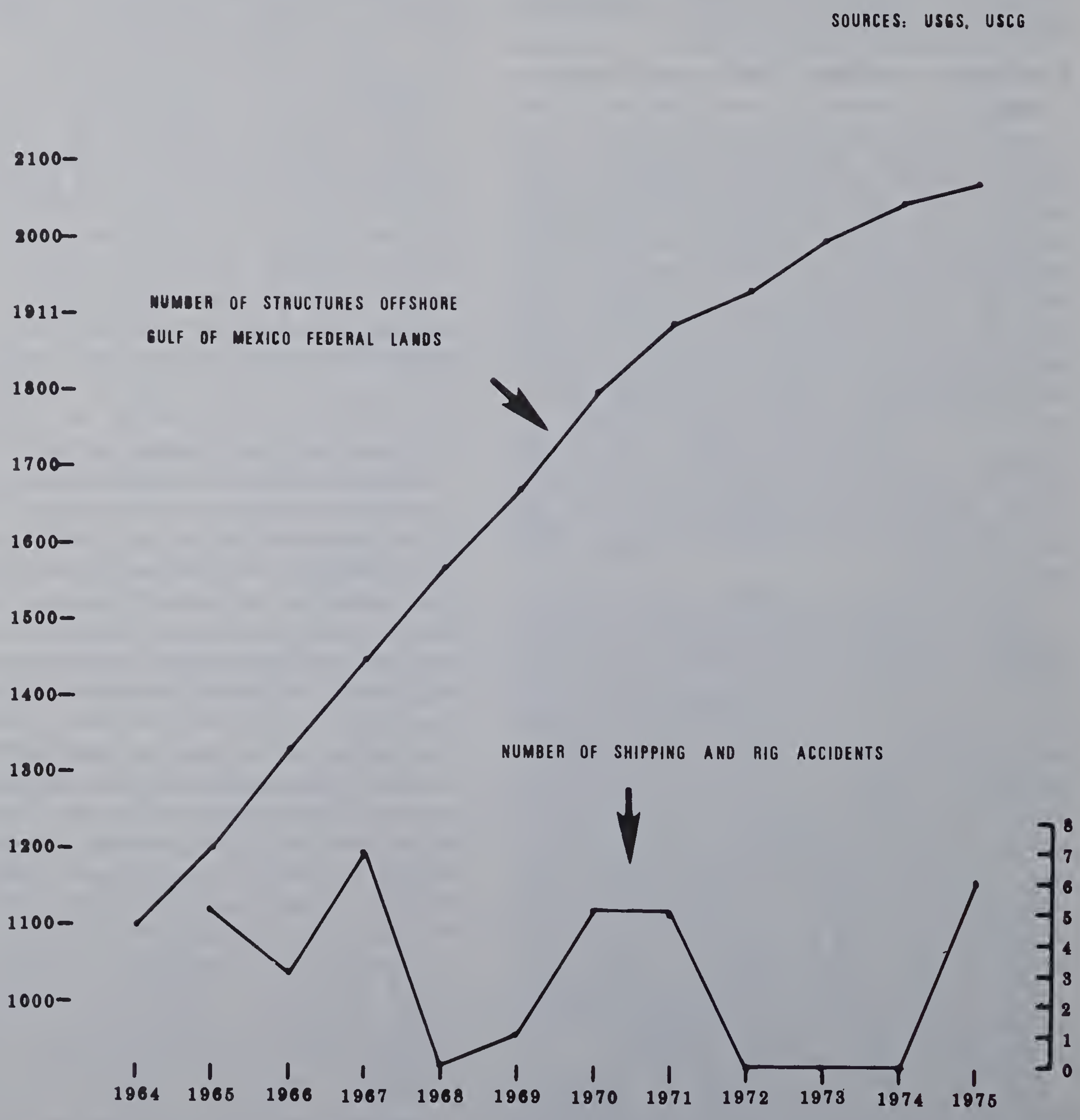
The most serious environmental hazard involving offshore structures and shipping accidents would occur in the case of an oil tanker colliding with a platform. In this theoretical case, supertankers might be considered in a more favorable light than small tankers if the following were the case: The offshore terminal buoy process were used, known as offshore deepwater terminals or "superports". The fairway, the area near the fairway, and the area around the terminal buoy had no nearby bathymetric hazards, or these hazards were carefully surveyed and marked. The supertankers were kept in the fairways in the area of offshore structures. The supertanker traffic was restricted to one way traffic in the fairways so that tankers were never on head-on courses.

In summary, the possibility exists for an increased number of collisions to occur as the number of platforms increase. It has been predicted this proposed sale will result in the addition of between 20 and 40 new platforms in the OCS.

F. Impact on Military Uses of the Continental Shelf

The Gulf of Mexico is used rather extensively by the Navy and Air Force for conducting military training and research operations. These current activities consist of missile testing, ordnance testing, drone recovery operations, electronic counter measure (ECM) activities by the Air Force and training of military personnel. Mine research activities are conducted by the Department of the

Figure III-3 **ACCIDENTS INVOLVING VESSELS AND OFFSHORE STRUCTURES**



Navy. Most of this activity takes place in areas designated for these purposes. Live ordnance testing by the Air Force occasionally involves emergency release of ordnance outside designated bombing areas; however, these are limited to practice bombs containing a 10-pound explosive. Because Air Force procedures provide for dropping ordnance over water in the event of an emergency, which precludes the use of a designated salvo area, a potential hazard exists. Such emergencies have occurred in the past, and ordnances have been jettisoned as far shoreward as Choctawhatchee Bay. No quantification as to the amount of ordnance located in and outside the salvo area was available. The possibility of occurrence of unexploded munitions on the ocean floor in the proposed lease sale area is extremely remote.

Oil and gas operations in an ordnance disposal area are potentially hazardous. The accidental detonation of munitions during the course of oil and gas drilling or other activities, should it occur, could result in loss of life, destruction of property or creation of a potential for fire and polluting events and death or injury by concussion to marine life. At this time, we consider the probability of occurrence low because unexploded ordnances and sunken WWII vessels are detectable through magnetometer surveys and sophisticated magnetic detection devices used as part of geophysical survey activities. Also, in many cases, divers can be used as part of geophysical survey activities. Also, in many cases, divers can be used to aid in locating and plotting munitions and sunken vessels on the ocean floor.

The possible use of shallow, nearshore portions of the continental shelf for ordnance disposal would prohibit full exercise of the multiple use concept common to natural resource management programs. However, it is not Department of Defense (DOD) policy to dispose of ordnance in shallow waters. Such disposal is only carried out in an extreme emergency and only when necessary for the preservation of life or saving of an aircraft and never as a routine disposal procedure. Therefore, this conflict is not anticipated should this proposed sale be held.

G. Impact on Beach and Shoreline Recreation

Recreational activity on beaches and in shoreline areas could receive impacts from pipeline construction onshore, from oil spills, and from the placement of onshore facilities (such as production terminals or transfer facilities) should they be located in or near a recreational area. Additionally, minor impacts from debris wash up can result from OCS construction efforts, well support activities, and from recreational fishermen who will be attracted to the additional platforms that may be added to the OCS as a result of this proposed sale.

No pipelines are projected to be brought ashore as a result of this proposed sale unless production results in an area remote from existing transportation facilities. If a pipeline crosses a beach area used for recreation, there will be an impact. The area of beach disturbed by construction would be fairly small (9 meters wide) and high tides following burial of the pipeline would soon serve to restore the beach terrain. Restoration of the beach would take longer, most likely requiring a storm tide or high winds to obliterate the effects of excavation. Should a pipeline enter a marsh shore there would be little beach activity affected; however, there could be long lasting visual impacts due to vegetative and drainage disturbance in the laying process. Likewise, a pipeline crossing a shore backed by forest vegetation will produce an obvious corridor which may be noticeable for many years. Physical interference with recreational activities, should a pipeline be needed, will be minimal and short-lived.

If production terminal facilities are located in or near a beach or any other area used for recreation, there will be an adverse impact from disruption during the construction phase and elimination of about 16 hectares per terminal plant for recreational uses. This latter impact would be long-term and restoration of the area, if attempted at all, would have to await the depletion of the offshore production which the plant would be designed to serve. These impacts may tend to diminish quality of the area for recreational enjoyment. It is anticipated this proposed sale would generate 0-2 onshore terminal and storage facilities to accommodate oil and gas production from this sale. However, unless discoveries occur remote from existing facilities and pipeline networks, it is not expected that construction will occur on new sites. It is probable that any expansion needed will take place on existing terminal sites. Neither is it expected that any new gas processing facilities or refineries will be needed as a result of this proposal. Water sports such as swimming, diving, spearfishing, fishing for finfish and shellfish and boating would also be directly affected by an oil spill. These would also be affected where chronic low-level discharges have caused a degradation of the environment.

Water enhanced recreation activities such as beachcombing, painting, nature study, camping or sunbathing on a beach or marine associated shoreline would be made much less attractive for an indeterminate period if an oil spill were to come ashore.

Removal of oil from beaches used for recreation in the area under consideration would probably involve removal of the contaminated sand and possible replacement of the sand, if needed. The time period of clean-up in this case would depend on the extent of beach area affected. Recreational use of the area would be precluded during the time that oil covered the beach and also during the clean-up process.

The impacts of an oil spill discussed above would be more keenly felt if the recreational area involved is intensively used or considered to have unique or outstanding recreational values, such as Grand Isle State Park, Galveston Island or Padre Island National Seashore. Not only would the impact be felt by the recreational users of the area, but, consequently, the community of businesses whose economic well-being depends on use of their recreational resources by tourists. If an oil spill were to cover outstanding recreational beaches during the height of the recreational season, in that residents and tourists would not be attracted to a beach area contaminated by oil or undergoing a clean-up process, and there would be a resultant economic loss.

As a result of this proposed sale, approximately 280 kilometers of new pipeline may be needed and possibly two new onshore storage terminals. Location of facilities would, of course, depend upon which tracts are leased and where new production actually occurs. It is unlikely that any new pipeline land-falls or shore facilities would be needed in the central Gulf area.

Of the 120 tracts considered for lease approximately half lie off the coast of Texas and half off the coast of Louisiana (see Visual 1). The closest tracts to the coastline are within 5 km (3 mi) of Louisiana's shoreline and they extend as far out as 193 km (119 mi).

In relation to some of Texas' primary recreation shoreline areas nine tracts proposed for lease lie seaward of Padre Island National Seashore, the closest of which is 24 km (15 mi) from the beachfront. Three tracts lie 18–21 km (11–13 mi) from Mustang Island and four tracts fall within 21–27 km (13–17 mi), of Galveston Islands beaches.

Grand Isle, which includes Grand Isle State Park, is Louisiana's most intensively utilized Gulf Coast recreation shoreline. The closest tract offered for lease lies more than 20 km (12 mi) from Grand Isle. One tract offered lies 13 km (8 mi) from the Chandeleur Island chain which is part of the Delta-Breton National Wildlife Refuge area. Most of the islands in the Chandeleur chain have been added to the National Wilderness System. The one tract offered within sight of this shoreline will not visually violate the wilderness character of the Breton Wilderness area as several tracts have been leased and developed in closer proximity to this established wilderness area.

In the Appendix is a matrix analysis which provides quantitative impact probability on an individual tract basis. Proximity to recreation areas is a major factor in determining the tract-by-tract evaluations.

Barrier islands along the Texas and Louisiana coasts offer considerable protection to bays and estuaries against encroachment of offshore oil spills. These barrier islands and their beaches are a major recreational resource in their own right and oil spill damage could be significant. However, where wave action is strong the effects of an oil spill should be shorter lived on the outer beaches than in the bays and estuaries.

In summary accidental oil spills of considerable volume resulting from exploration and development of offered tracts or transportation of oil produced pose the greatest risk of affecting shoreline recreation areas. Historically petroleum development in the Gulf of Mexico over the past 30 years has caused very little interruption of shoreline recreation. Besides oil spills, debris improperly discarded offshore by oil field workers and commercial and recreational fishermen, some of which are attracted to offshore platforms, causes minor impacts on recreation beaches when washing ashore.

Because of the extensive offshore petroleum activity already in the Gulf of Mexico the additional offering of 120 tracts should have very little cumulative effect on shoreline recreation areas. Maintaining the current level of production offshore will result in minor oil spills and pollution instances which can and have caused hydrocarbon residues that often come ashore. These residues form globs referred to as tar balls. When bathers or beach users encounter tar balls it significantly detracts from enjoyment of their recreational experience.

H. Impact on Aesthetic and Scenic Values

If air quality permits unlimited visibility, some portion of a 30 m high offshore structure could be seen from the beach if it were located 27 km or less from shore.

Thirty-one of the tracts offered south of Louisiana are close enough to shore to permit observation of operations during favorable conditions by someone on the Gulf shoreline peering seaward. In the Texas area 19 tracts are near enough to shore to cause a visual impact.

The effects of visual impacts caused by the observation of structures resulting from this proposed sale will be lessened because many offshore structures are already visible from the segments of coastline that would be affected by the proposed sale. For example, at present there are approximately 50 structures visible from the Delta-Gulf Island NWR (Widner, 1975).

Any floating material such as debris or oil that is cast upon the beach or washed into a bay would constitute an impact upon the aesthetic values for users or owners of the area.

Even after burial of a pipeline, the remaining scars will cause an impact on the aesthetic values of the beach and associated shoreline for some period of time. It is our estimation that the impact will endure for at least a year, or until sand has been redistributed by wind, tides, and rain and another growing season brings about revegetation.

Revegetation of dunes crossed by pipelines would reduce adverse effects from an aesthetic and scenic viewpoint and would decrease the chance of destruction of the dunes by erosion. However, it is not within the Federal Government's authority to require the revegetation of affected dunes unless they are on Federal lands. State or local authorities may require revegetation of dunes disrupted by pipeline installations.

Canal and ditches constructed in marsh areas which are not backfilled will have an adverse impact on aesthetic values. The laying of a pipeline in such an area would result in an open canal or ditch through the marsh. However, this would be an add-on effect in much of the central Gulf region since there are at present numerous waterways of this type.

There would be an adverse impact on aesthetic and scenic values resulting from construction of onshore terminals, storage facilities and pumping stations if these facilities are located in areas which are valued for their natural or scenic qualities. Some people will find the visual impact of these facilities aesthetically displeasing. There may also be noise pollution associated with vehicular traffic to and from these facilities and noise pollution resulting from pumping stations that would reduce the serene and natural qualities of an otherwise aesthetically enjoyable area.

The probability for the aforementioned impacts to occur is considered low. However, if any should occur, the duration would depend on numerous variables such as the productive life of the tracts proposed, and the extent would be partly reflected in individuals' own values.

In summary the most lasting impact on aesthetic and scenic values would result should the 50 tracts closest to shore be leased. Impact along the Texas Coast where beachfront recreation resources and use are extensive is considered minimal as tracts offered for lease are at least 10 miles (16 km) from the shoreline. Even though a rig operation should be perceptible at such a distance it would be difficult to distinguish from a seagoing vessel. Such a contrast on the far distant horizon will have a minor impact on aesthetic sensitivities.

Along the Louisiana coast where 22 tracts fall within 3 to 10 miles from the shoreline, exploration and development activities will cause a recognizable contrast to the natural offshore horizon. Two factors tend to soften this impact: (1) Most of Louisiana's shoreline has no public access therefore, few people go to the shoreline to enjoy an uninterrupted ocean view, (2) Where access is provided, Grand Isle for example, extensive offshore activity from former state and Federal lease sales has already added significant contrast to ocean views. Tracts 45-116 and 45-101, should they be leased, would be the most sensitive to scenic values. This determination is based on the proximity of these two tracts to shoreline resources highly valued for their primitive character. Tract 116 lies 8 miles south and west of the established Breton National Wilderness and tract 101 lies 6 miles south of the proposed Isles Derniere State Preservation Area.

Aesthetic values will be severely affected for a short duration should significant quantities of crude oil come ashore in a recreation use area. Additionally the offshore activity stimulated by this proposed sale will add to the floating debris improperly discarded in the Gulf of Mexico, much of which ends up on beachfront areas detracting from aesthetic enjoyment and adding to maintenance problems.

I. Impact on Historical and Archaeological Sites, Structures, and Objects

This proposed sale could impact cultural resources both offshore and onshore.

Offshore cultural sites such as known or undiscovered shipwrecks or prehistoric living sites could be impacted by a number of operations carried out in relation to the proposed sale. The placement of drilling rigs (jackup rig legs or mats, drillship or semi-submersible rig anchors, and the actual drilling equipment), pipeline burial operations, and the construction of terminal, storage or pumping facilities all may cause damage or destruction to cultural resources. Operations which place objects on the ocean floor could crush the fragile wood remains of historic ships. Operations which disturb the bottom (drilling holes, setting anchors, burying pipelines) can also destroy or damage all or parts of prehistoric living sites by moving artifacts out of their proper sequence, lifting objects from the protective mud or sand cover and allowing them to be moved by currents, and by actually damaging or destroying artifacts. Unless a magnetometer survey is done of an area prior to the placement of a pipeline or platform, the magnetic signature of a slightly scattered shipwreck could easily be either totally hidden by the much larger anomaly caused by the more modern structure, or the anomaly might be easily interrupted as part of the magnetic signature of the platform or other structure.

Should oil spills occur, and should some of the oil sink to the ocean bottom due either to natural processes or cleanup activities, cultural resources could become coated with oil. The removal of the oil during salvage could destroy or damage the cultural resource, and the presence of oil residue in organic artifacts could negate their being dated by carbon dating procedures. (See section ''Mitigating Measures in the Proposed Action'' for a special stipulation proposing to precede any operations with a Cultural Resource Survey).

Therefore activities related to this proposed sale could adversely affect some cultural resources such as submerged early Indian sites or sunken historical vessels, on the OCS. However, it is also possible that a beneficial impact could occur if new cultural resources are discovered during pre-operation surveys or during operations.

Shipwrecks: There are two blocks considered for leasing in proposed Sale 45 which are known to contain shipwrecks. In the state portion of South Timbalier, block 11 (tract 45-104) is a wreck of undetermined origin. The wreck lies outside of Federal jurisdiction and no problem or conflict can be forseen in leasing the Federal portion of the block. Galveston Area, Block 391 (tract 45-30) also contains an unidentified shipwreck. An archaeological survey will be required prior to exploration or development activities to determine the exact location of the wreck and assure the planned activities by the lessee will not affect the potential cultural resource. Tract 45-26 lies adjacent to the block which contains the sunken USS Hatteras. The Hatteras has been nominated to the National Register and plans are underway by the Galveston Historical Commission to salvage the ship as a historic resource. Should the adjacent block be leased no activities would be allowed that could be determined to affect the historical value of the USS Hatteras.

Many of the tracts offered for leasing fall within zones of possible shipwrecks. A cultural resource survey will be recommended in those lease blocks where there is the greatest probability of historic shipwrecks. Any such unknown shipwrecks should thereby be discovered and oil and gas activities can be planned so as to avoid damage to any known shipwreck.

Pre-historic Living Sites: No submerged prehistoric living sites are presently known in the OCS off Texas and Louisiana. Cultural resource surveys recommended for certain lease tracts are designed to identify potential early man living sites as well as shipwrecks. Should a site be detected, activities will be controlled so as to avoid damage to the site.

Proposed Sale No. 45 will add only a small increment to the extensively leased and ongoing oil and gas activity in the Central Gulf of Mexico. It is possible that any submerged sites that exist in the OCS may have been affected by this activity. Due to the nature of oil and gas operations offshore it is unlikely that the destruction of cultural resource material would be noticed. The magnitude of the destruction of cultural resources, should they occur, is extremely difficult to determine.

Onshore development resulting from this proposed sale could negatively affect cultural resources. The building of onshore bases, natural gas processing plants, and trenching for pipelines might destroy or disturb the undiscovered remains or artifacts of early Indian groups and colonial occupations. Oil spills from pipelines onshore could seep through the ground and coat artifacts, adversely affecting their value and usefulness.

A few of the more than 200 coastal county sites listed on the National Register of Historic Places (See Visual 1) lie adjacent to the Gulf shoreline where they could be affected by oil spills coming ashore, or by construction of onshore facilities. Onshore facility sitings and pipeline landing can be controlled and are not predicted to be significant as a result of this proposed lease sale.

The activities and pollution caused by this sale in combination with the 38 former Gulf of Mexico sales and probable future offerings will increase the potential for damaging offshore and onshore cultural resources. Affects on known resources can be avoided and are therefore considered to be minimal.

J. Impact on Sport Fishing and Recreational Boating

A major oil spill would adversely affect sport fishing and recreational boating. Boaters and fishermen would not want to soil their boats by entering a contaminated area for the duration of the spill incident. In addition, fish landed could be tainted by spilled oil.

Aside from damage caused by oil spills, there is considerable evidence that oil and gas operations have a favorable impact on sport fishing activities. One favorable impact is the result of sports fish concentration due to the artificial reef effect of offshore platforms. In the open sea, offshore platforms provide habitat for organisms which provide fish food and also cover in areas that are largely devoid of those essentials. Myriad forms of microorganisms in the water drift by these structures and attach themselves, soon encrusting all exposed surfaces on the platform. Hard substrate is necessary for encrusting organisms: barnacles, hydroids, corals, mussels and other invertebrate organisms which serve as links in the food chain. Randall (1968) has stated that artificial reefs provide protection, food sources, spawning sites and spatial orientation markers for fishes. The same author found that artificial reefs attract available fish from surrounding waters, and increase the size of some populations by providing additional protected areas and food for both the young and adults. The typical platform located in 30 m of water will have a surface area of about 0.8 hectares (over 8,082 square meters) (Shinn, 1974). Other advantages of these structures are the free movement of water through and around them and their high profile. The high profile provides habitat for a wide variety of fish ranging from the turbid dark bottom zone to the lighter and clearer surface waters. Platforms are easily located by boaters and fishermen and the platforms and their personnel are a source of emergency assistance for all offshore sportsmen.

Permanent platforms located near the top or slopes of small banks or reefs could reduce a fisherman's accessibility to the natural systems. Platforms may also recruit marine animals from the reef, thereby temporarily reducing the natural reef's potential as a fishing bank.

Offshore platforms are the major focus of sports divers from coastal Louisiana and may be expected to contribute significantly to the sport as their number increases in other areas of the Gulf. Divers are drawn to these structures for spear fishing, photography and general pleasure diving. The submerged portion of structures contribute to safety by assuring the divers' orientation to depth and distance (Estopinal, 1975).

It is expected that between 20 and 35 new platforms will be added as a result of this proposed sale to the more than 700 multiwell structures in existence in the northern Gulf of Mexico (USGS, 1976).

In summary this proposed sale is likely to increase fishing opportunities in the OCS as an incidental result of offshore platform construction. The boating industry and marine supply enterprises should be indirectly stimulated as specialized equipment is required by anglers venturing several miles into the Gulf of Mexico. Pollution instances resulting during the exploration, development, production, and transportation phases on leases sold will temporarily discourage sport fishing and recreational boating in limited areas.

This proposed sale in conjunction with former sales and anticipated future sales will further increase the sport fishing attraction of the general OCS area and add to the potential pollution causing sources which can discourage sport fishing and boating both offshore and nearshore.

K. Impact on Socio-Economic Conditions

The principal economic effects of the oil and gas produced as a result of this proposed sale are anticipated to be experienced in the states of Louisiana and Texas. After leasing, exploration and development activities have been completed, the exact geographic location in which economic activity will be most likely to result can be more precisely identified.

Oil and gas produced as a result of this proposed sale will become available at some time in the future (possibly beginning in 1 to 5 years), and the impact due to the economic activity resulting from this proposed sale will take place in the economic climate that exists at this time.

Recently an increased number of rotary drilling rigs have been in operation, with the total number of wells drilled during 1975 higher than the number of wells drilled during 1973 and 1974.

In order for the oil and gas discovered as a result of proposed Sale No. 45 to become available to consumers, platforms would have to be constructed, wells would have to be drilled and pipelines linking the additional production facilities to existing transportation systems would be required.

This activity can be considered to be an extension or continuation of present employment and industrial patterns related to the existing petroleum based economy within the region.

However, some additional duration of employment may be expected to result from the exploration, production and initial processing of crude oil and natural gas that might result from this proposed sale, and an estimate of this employment has been based on data published by the Bureau of Census (1972).

This employment may be an addition to the work force already present in the states adjacent to the Gulf of Mexico, providing that a high level of drilling and production activity is maintained in other areas. In the event that surplus skilled labor is available within the required specialties, the impact of this proposed sale on employment in exploration and production related activities is seen to be a tendency to preserve the existing employment.

Additional employment impact, if it materializes, is anticipated to be experienced in the fields of oil and gas exploration, production and natural gas liquids treatment.

As a means of reporting employment and wage and salary payments, the Bureau of Census publishes a series of reports entitled, "*1972 Census of Mineral Industries*".

Data pertaining to employment in offshore oil and gas exploration and production activities during the year 1972 have been included in the section on History and Projected Growth.

The data provided within MIC 72 (1)-13A, Oil and Gas Field Operations, SIC 131, included tabulations of the number of offshore wells operated during December, 1972, as well as the number of wells drilled during the year. These data are summarized on Table III-8.

During the year 1972, approximately 5,100 persons were employed in offshore drilling activity (SIC 1381) adjacent to Texas and Louisiana. A comparison of this number of employees with the number of wells drilled in this area indicated a ratio of 6.72 employees per drilled well. During the third, fourth, and fifth year following the proposed sale, an average of 10% wells may be drilled, indicating a potential employment effect amounting to 726 jobs during those years.

During the month of December, 1972 there were 3,041 producing oil wells and 1,629 producing gas condensate wells were classified as shut-in during December, 1972. The total number of oil and gas condensate wells, both producing and shut-in, amounted to 7,575 wells.

Within the industry classification of SIC 1311 (Operating oil and gas field properties) and SIC 1389 (Miscellaneous oil and gas field services), approximately 7,500 persons were engaged in offshore activities.

Based on the relationship between the number of wells and the number of employees, a ratio of one employee for each well is suggested if all

Table III-8

1. Wells Completed in Offshore Areas (1972)

Area	Oil	Gas Condensate	Dry	Service	Total
Louisiana Offshore	232	166	299	7	704
Texas Offshore	4	20	30	0	54
Gulf of Mexico	236	186	329	7	758
California	47	0	3	25	79
Alaska	4				
Total Offshore	287	186	332	32	837

2. Wells Operated in Offshore Areas (December, 1972)

Area	Producing Oil	Producing Gas/Cond.	Shut In Oil	Shut In Gas/Cond.	Total
Louisiana Offshore	3,021	1,512	2,086	741	7,360
Texas Offshore	20	117	18	60	215
Gulf of Mexico	3,041	1,629	2,104	801	7,575
California	1,482	11	370	8	1,871
Alaska	113	3	12	2	130
Total Offshore	4,636	1,643	2,486	811	9,576

Source: Census of Mineral Industries (1972) wells are included, or 1.6 employees per well if only the producing wells are included. The maximum of producing wells estimated to result from this proposed sale is 250, indicating that between 250 and 400 persons would be employed during the production phase.

Those persons employed in establishments which are primarily engaged in producing liquid hydrocarbons from oil and gas field gases are enumerated in the applicable County Business Patterns under the category of SIC 132. Specific data on the number of establishments and the number of employees were published only for the states of Louisiana and Texas, although processing plants were noted as being present in the other coastal states.

The natural gas production estimated to result from this proposed sale amounts to 500 million cubic feet per day, or approximately 182 billion cubic feet per year. This amounts to approximately 1.3 percent of the volume of natural gas processed in plants in Louisiana and Texas during 1972, and would indicate an average annual employment of 68 persons.

Estimated of the total direct employment which will result from exploration, production and natural gas processing as a result of this proposed lease sale amounts to approximately 275 to 1200 persons:

Category	*Annual Employment*
Oil and gas well drilling	47– 726
Oil and gas production	160– 400
Natural gas liquids extraction	68– 68
Total employment	275–1194

The average taxable wages paid within these classifications was calculated from the payroll data provided in the Census of Mineral Industries, and are expressed in 1972 dollars.

Total annual wages of the 726 employees of the drilling industries would amount to approximately $7.8 million; the annual wages of the 400 employees during the production activities would amount to approximately $5.2 million, and the annual payroll of employees of the natural gas processing industry would amount to approximately $0.7 million. The total payroll of the employees is estimated to amount to approximately $143 million (1972 dollars).

These total employment figures imply that all of these activities are being carried forward during the same year. Following the completion of the producing wells, a smaller number of employees may be employed in drilling activities, primarily in well workover activites, and therefore, the employment in oil and gas production and natural gas liquids extraction may be a more precise estimate of employment and payroll effects after the 5th year following the proposed sale.

Persons directly employed in operations relative to the exploration and production of oil and gas can be expected to spend their wage and salary income for purchases of goods and services.

The provision of these goods and services will require the employment of other persons. The number of persons employed in support industries would be dependent on both the consumption patterns of those directly employed, as well as the extent to which labor within an economic system was engaged in the production of goods for consumption within the same system. Since a wage or salary worker would be expected to meet the largest portion of his needs within the area of his residence the expenditure of wage and salary payments for items produced outside of the local economy would be expected to generate additional support employment in the area in which the item was produced.

The value of the wage and salary payments made to the persons employed in support activities has been determined by calculating an average wage and salary payment for the two state area from data included within the applicable County Business Patterns publications as shown in Table III-9.

The number of persons employed in support industries, or the employment induced in other sectors of the economy shown by increases of employment in basic industries has been treated in *Offshore Revenue Sharing*, a publication prepared by the Gulf South Research Institute of Baton Rouge, Louisiana, and *The Structure of the Texas Economy*, prepared by Herbert W. Grubb of the Office of Information Services in March, 1973. A paper prepared by Dr. Grubb in 1972, entitled, "*Economic Aspects of the Petroleum Industries of the Texas Economy*" contained some data for determining the induced employment which results from oil related activities.

The economic impact of a million dollar change in output of petroleum refining is shown to be $2.56 million. This represents the direct value of output from these industries plus the indirect ef-

Table III-9 Estimated Income of Persons Employed by Oil and Gas Support Industries in the Gulf of Mexico Region

State	Total Taxable payrolls Mid March 1972 (Thousands)	Number of Employees Mid March 1972	Taxable Payroll: per employee Per Quarter	Annual
Louisiana	$1,419,694	852,793	$1,664.75	$6,659.00
Texas	5,195,118	3,125,175	1,662.34	6,649.36
Totals	$6,614,812	3,977,968		
Two State Average			$1,663.54	$6,654.18
United States	$108,084,852	58,015,904	$1,863.02	$7,452.08

Source: County Business Patterns
Bureau of the Census

fects from other related industries, as well as the induced effects of the changes in income of the wage and salary earners (households) involved. Each million dollar increment in output of crude is estimated to employ 50 workers within the economy, of which 11 are employed directly in oil field work and 39 are employed directly in the support and induced industries (Grubb, 1972). This estimate indicates that 3.5 persons are employed in support and induced industries for every person directly employed in oil field work.

In *Offshore Revenue Sharing*, the primary employment estimated to result from OCS activity amounted to 40,300 persons engaged in activities within the categories of mining, manufacturing, construction, chemicals, and allied products and refining. The supporting employment was estimated to amount to 84,100 persons, indicating a relationship of approximately 2.08 persons employed in support industries for every person employed in the petroleum related industries.

For the purpose of estimating impact that may result from this proposed sale, employment in support industries will be based on an estimated 2.1 persons employed for every person employed in the petroleum related industries.

Since direct employment is estimated to amount to approximately 1,194 persons during the years of peak activity, the induced employment during these years can be estimated to amount to an additional 3,500 persons. Based on an average annual wage or salary of approximately $6.654 in 1972 dollars, estimations of total wage and salary payments will amount to approximately $16.6 million in 1972 dollars.

Additional employment can be anticipated as a result of the required construction of pipelines, production platforms and other facilities. It is anticipated that the economic stimulus that may result from these activities will be experienced primarily in the states of Louisiana and Texas.

Standard Industrial Classification 3533, Oil Field Machinery and Equipment, includes establishments primarily engaged in manufacturing machinery and equipment for use in oil and gas fields or for drilling water wells. This classification includes the manufacture of rock bits, derricks and rigs, drilling tools, oil and gas machinery and equipment.

The relative importance of this industry in the Gulf of Mexico area is apparent. Of a total U.S. employment of 35,915 in this industry, approximately 20,000 are employed in the State of Texas and an additional 1,607 in the State of Louisiana.

The construction and installation of fixed production platforms required by this proposed sale will probably be accomplished in existing Gulf of Mexico facilities.

On September 10, 1974, the National Petroleum Council transmitted a report concerned with the availability of manpower and equipment for the drilling and production of oil during the years 1974-1976. This publication, entitled *Availability of Materials, Manpower and Equipment for the Exploration, Drilling and Production of Oil 1974, 1976*, discussed the capabilities of the yards fabricating offshore production platforms and noted that contractors estimated that the capacity of the yard facilities was approximately 200,000 tons per year, and that expansion plans could be expected to increase yard capabilities over the years 1975 and 1976.

Mr. C. L. Graves, J. Ray McDermott and Co., provided testimony to the Council on Environmental Quality, concerning potential sites for the construction of platforms. Mr. Graves noted that during the first 4 to 5 years of offshore development, it is cheaper to build platforms at Morgan City, Louisiana and transport them to the drilling and production areas. McDermott has transported platforms to the U.S. Pacific Coast, Central and South America, the west coast of Africa, the Middle East, and the North Sea. When transportation time becomes prohibitive, then the company builds a fabrication facility near the development area (CEQ, April, 1974).

The possible location for the construction of platforms required by this proposed sale cannot be determined at the present time. It is believed most probable that they will be constructed in existing yards in the Gulf of Mexico region.

The following list of the locations of facilities for the construction of platforms was compiled from various published sources supplemented by personal contact with officials of the various organizations.

Platform Construction Facilities:
- California:
  - Kaiser Steel (Oakland)
  - Kaiser Steel (Vallejo)

These yards assemble platforms from prefabricated components produced at Napa and Fontana fabrication yards.

- Louisiana:
  - Avondale Shipbuilding (Morgan City)
  - Avondale Shipbuilding (Harvey)

Benoit Machine (Houma)
Delta Fabrication (Houma)
DuPont Fabricators (Amelia)
McDermott Fabricators (Morgan City)
McDermott Fabricators (Harvey)
Teledyne Movible (Morgan City)
Williams-McWilliams (Harvey)
Williams-McWilliams (New Orleans)

Texas:
Brown and Root (Houston)
Gulfco (Freeport)

Virginia:
Brown and Root (Cape Charles) proposed facility

Washington:
Brown and Root (Astoria) proposed facility
Kaiser Steel (Gray's Harbor) proposed facility

The crude hydrocarbons produced as a result of this proposed sale will probably receive further processing within existing facilities in the Gulf of Mexico area. Facilities such as refineries, existing crude oil and natural gas gathering and transportation systems and petrochemical plants will be utilized to the maximum extent possible, and it is anticipated that additional facilities of this type will not result from this proposed sale.

In summary, it appears probable that oil and gas produced as a result of this proposed sale will provide for the continuation of existing patterns of employment in those areas adjacent to the Gulf of Mexico where the industrial infrastructure related to the oil and gas industry is established. Activities such as the construction of drilling equipment and the necessary foundation and production facilities will probably be accomplished in existing manufacturing facilities.

The cumulative impact of proposed Sale No. 45 is to continue the existing petroleum and natural gas based exploration, production, processing, and transportation activities carried on in the Gulf of Mexico region. The employment and income effects are such as to form additional domestic employment and income for persons skilled in offshore operations. The Gulf of Mexico onshore and offshore region has provided a significant portion of the Nation's energy supplies for more than two decades.

Section IV

Mitigating Measures Included in the Proposed Action

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

BLM
NEW ORLEANS OCS

A. Operations—Protection of the Marine Environment

1. Regulations—Summary of OCS Orders—Nos. 1-15

Regulations governing OCS mineral operations in the Gulf of Mexico are contained in Title 30, Code of Federal Regulations Part 250, and OCS Orders 1 through 14, which become effective as follows:

OCS No.	Title	Effective date
1.	Marking of Wells, Platforms and Fixed Structures	August 28, 1969
2.	Drilling Procedures	January 1, 1975
3.	Plugging and Abandonment of Wells	August 28, 1969
4.	Suspensions and Determination of Well Producibility	August 28, 1969
5.	Subsurface Safety Devices	June 5, 1972
6.	Completion of Oil and Gas Wells	August 28, 1969
7.	Pollution and Waste Disposal	October 1, 1976
8.	Platforms, Structures, and Associated Equipment	October 1, 1976
9.	Oil and Gas Pipelines	October 30, 1970
10.	Sulphur Drilling Procedures	August 28, 1969
11.	Oil and Gas Production Rates, Prevention of Waste and Protection of Correlative Rights	May 1, 1974
12.	Public Inspection of Records	February 1, 1975
13.	Production Measurement and Commingling	October 1, 1975
14.	Approval of Suspensions of Production	January 1, 1977

An additional OCS Order, No. 15, entitled "Submittal of Information Concerning Development Plans to Coastal States" has been proposed. These 15 OCS Orders are briefly discussed below and are reprinted in full in Appendix B. It should be noted that revisions have been proposed for OCS Orders Nos. 2, 6, and 9, but there is not indication at the present time when, if ever, the revisions will supercede those presently effective.

Leasing regulations are contained in Title 43, Code of Federal Regulations, Part 3300. The regulations establish procedures and requirements to be followed in all stages of lease operations: exploration and development, drilling, production, transportation (pipeline construction and operation) and termination.

Regulations governing the safe conduct of mineral operations and development of the OCS are administered by the U.S. Geological Survey. In the case of violations, leases are subject to cancellation and lessees are subject to the penalty of the OCS Lands Act.

A general description of operating requirements to which this proposed sale would be subject under the Gulf of Mexico OCS Orders follows. These Orders are presently in effect for OCS activities now ongoing in the Gulf of Mexico.

GULF OF MEXICO OCS ORDER NO. 1

This Order requires all platforms, drilling rigs, drilling ships and wells to have signs of standard specifications for identification of the operator, the specific lease block of operation, and well number. It also requires the marking of all subsea objects which might present a hazard to other areas of the OCS.

This Order states that all subsea objects resulting from lease operations which could present such a hazard must be identified by navigational markings, of a design approved by the Supervisor and not inconsistent with applicable U.S. Coast Guard Regulations. Under this provision, the potential for accidents to subsea production systems, "stubs", fishing gear, and ship anchors is substantially reduced as is the possibility of an oil spill from such an accident. This effectively eliminates some of the impacts to these elements which were discussed in Section III.

GULF OF MEXICO OCS ORDER NO. 2

Order No. 2 concerns procedures in drilling of wells. It requires the operators to file an application for drilling which includes information on the drilling platform or vessel, casing program, mud program, blowout prevention equipment, well control training and safety training of operators' personnel, and a list or description of critical drilling operations which are or may be performed. The Order then describes certain procedures or equipment to be used in each phase of the drilling operation.

All wells must be cased and cemented in order to support unconsolidated sediments, prevent leakage of fluids between formations or pressure changes in the well. If there are indications of improper cementing, the well must be recemented and logs run to indicate proper sealing of the well hole walls. The casing design and setting depths are to be based on all engineering and geological factors including the presence or absence of hydrocarbons, abnormal pressure, potential hazards, and water depths. A pressure test is required of all casing strings, except the drive or structural casing, to determine the presence of leaks or inadequate cementing. The use of casing as described in this Order should eliminate potential impacts of fresh water zone contamination, lost production, or the possibility of accidents caused by improper casing.

Blowout preventers and related well control equipment must be installed, used and tested in a manner necessary to prevent blowouts. A specific number of these preventers must be used in every well and they must include a fail-safe design; dual control systems, and fail-safe valving on critical lines and outlets.

The characteristics, use, and testing of drilling mud, and the conduct of related drilling procedures shall be such as to prevent the blowout of any well. Sufficient quantities of mud are to be maintained and readily accessible for use at all times to insure proper well control. This part of Order No. 2 provides additional protection against possible blowouts (Section III.A-2).

Representatives of the operator will provide on-the-site supervision of drilling operations on a 24-hour basis. A member of the drilling crew or the toolpusher will maintain surveillance of the rig floor continuously from the time drilling operations commence until the well is either completed or abandoned. All supervisory personnel including drillers must be trained in present day methods of well control, and records of the training are to be kept at the well site. Weekly blowout prevention drill exercises are required of all rig personnel. These requirements will also substantially reduce the possibility of blowout or other rig accidents (Section III.A.2) and provide additional safety margins for all crew members.

Procedures to be followed when drilling operations are undertaken to penetrate reservoirs known or expected to contain hydrogen sulfide gas are now included in U.S. Geological Survey OCS Standard No. 1 (GSS-OCS-1), "Safety Requirements for Drilling Operations in a Hydrogen Sulfide Environment". This set of standard operating procedures will assure proper testing and safety of the crew as well as the drilling platform or vessel should H_2S be encountered. Hazards of H_2S are substantially reduced by the institution of these procedures.

Gulf of Mexico OCS Order No. 3

This Order is established to provide regulation of plugging and abandonment of wells which have been drilled for oil and gas.

For permanent abandonment of wells, cement plugs shall be spaced to extend 30 m (100 ft) above the top and 30 m below the bottom of fresh water, oil, and gas zones to prevent those fluids from escaping into other strata. Portions of a well in which abnormal pressures are encountered are also required to be isolated with cement plugs. Plugs are required at the bottom of the deepest casing where an uncased hole exists below. Plugs or cement retainers are required to be placed 30 m above the top and 30 m below any perforation interval of the well hole used for production of oil and gas. A "surface" plug 46 m (150 ft) long shall be placed in the smallest string of casing which extends to the surface. A pressure test must be made of the top plug below the surface plug, spaces between plugs must be filled with drilling muds of sufficient density to exert hydrostatic pressure exceeding the greatest formation pressure encountered in drilling each interval. The casing and piling will be removed to at least 5 m (15 ft) depth below the sea floor. For temporary abandonments, plugs and mud must be emplaced with the exception of a surface plug. (The temporary abandoned well would have to be marked in accordance with Order No. 1). The plugging requirement prevents the movement of contaminating fluids between formations or their escape into the ocean. The removal of casings and pilings reduces hazards to navigation and fishing gear.

Gulf of Mexico OCS Order No. 4

Order No. 4 provides for extension of a lease beyond its primary term for as long as oil or gas may be produced.

If these circumstances should occur, a lease can be extended beyond its initial term, pursuant to Section 8(b)(2) of the OCS Lands Act and Title 30 CFR 250.12 (d)(1).

A production test of at least two hours duration follow stabilization is required for both oil and gas wells. All pertinent engineering, geologic, and economic data is required to support a claim that a well is capable of being produced in paying quantities. Each test must be witnessed by an authorized representative of the U.S. Geological Survey, although under certain circumstances, an operator's affidavit or a third party test may be acceptable. The purpose of this Order is to guarantee that a lease has been found to be capable of producing oil or gas prior to granting an extension on the lease.

Gulf of Mexico OCS Order No. 5

This Order sets regulations for the installation, design, testing, operation, and removal of subsurface safety devices. The Order requires that all well tubing installations open to hydrocarbon-bearing zones shall be equipped with a subsurface controlled or a surface controlled subsurface safety device that is placed 30 m or more below the sea floor. All wells perforated and completed but not placed on production must be equipped with a subsurface safety device or tubing plug within two days after the well is completed. Subsurface safety devices should also be placed in injection wells unless they are incapable of flowing oil and gas. All safety devices must comply with the minimum standards set forth in the "API Spec. 14A, First Edition, October 1973, Subsurface Safety Valves" and recent supplements as approved by the Area Supervisor. Testing of the device must take place monthly for six months after installation and quarterly thereafter, if it does not operate correctly, it must be promptly removed with a properly operating device put in place and tested. Additional protective equipment is also required with the use of subsurface protective devices. In a case where tubing installations have been opened to hydrocarbon zones and are not equipped with subsurface safety devices (during workover), the installation must be so identified and such a device or tubing plug must be available at the field location to be emplaced if necessary. Records must be kept of all subsurface safety devices employed at each well with quarterly reports prepared on reasons for any failures of the devices.

This Order provides additional means to prevent blowouts and keep wells under control, thereby reducing risks described in Section III.

Gulf of Mexico OCS Order No. 6

OCS Order No. 6 provides requirements for oil and gas well completion and work over procedures for the Gulf of Mexico area. Requirements concerning blowout prevention, well control fluids, tubing and wellheads, and zone separation are proposed in the considered revision. Other requirements relating to the different type rigs, equipment and materials as well as housekeeping and safety concerns are discussed.

Gulf of Mexico OCS Order No. 7

OCS Order No. 7 sets forth a means to effectively control pollution of the marine environment from offshore petroleum operations. It requires that the operator must prevent pollution of the Gulf of Mexico and that the disposal of waste products must not create conditions that can adversely affect the public health, life or property, aquatic life or wildlife, recreation, navigation, or other uses of the Gulf. Its purpose is to detail requirements for pollution prevention and waste disposal.

OCS Order No. 7 requires that the operator must submit with the Application for Permit to Drill a detailed list of drilling mud components, chemicals and mud additives and concentrations to be used in drilling the well. The disposal of mud, drill cuttings, sand and other material is strictly controlled. It requires that all personnel must be thoroughly instructed in pollution prevention and details various requirements for reporting all spills of oil and liquid pollutants. Rigorous inspection schedules are required for all facilities.

Stand pollution control equipment must be maintained or available to each operator. The equipment must include booms, skimmers, cleanup material, and chemical agents (though chemical agents can only be used with the express consent of the Supervisor). The revised order provides that all applications for a drilling permit must include an oil spill contingency plan with provisions for varying degrees of response effort depending on severity of oil spill; identification of containments and cleanup equipment availability; notification procedures of responsible persons and alternatives in the event of an oil spill; and provision for specific actions to be taken after discovery and notification of an oil discharge. Should a spill occur, immediate corrective action must be taken.

Gulf of Mexico OCS Order No. 8

OCS Order No. 8 prescribes approval procedures under which the Supervisor is authorized to approve the design, other features, and the plan of installation and operation of all platforms, fixed structures and artificial islands to be used for oil and gas drilling and production operations in the Gulf of Mexico. Safety equipment and pollution control equipment is provided for in the order.

OCS Order No. 8 provides that the operator shall be responsible for compliance with the requirements of the order whether or not the facilities and equipment are operated or owned by him. A platform or structure must be designed for safe installation and operation for its intended use and service life at a specific site. In designing a platform or structure consideration must be given to wind, wave, and current forces, functional loading conditions, water depth, and soil condition. The application to install must specify its location, intended use, personnel facilities and be accompanied by a plat of its essential parts. Environmental data must be provided. The operator must certify in writing that the structure will be constructed, operated, and maintained as described in the application.

In the installation of platform equipment API standards may be utilized, however, the Supervisor may enlarge on these standards if he deems it necessary. These standards apply to all equipment such as separators, treaters, compressors, headers, and flowlines; all in the interest of efficient, safe and pollution-free operations. These high standards also apply to all electrical equipment, fire fighting systems, gas detection systems, and pressure vessels.

OCS Order No. 8 also prescribes requirements for the operation of all facilities such as producing operations, welding practices and procedures, and the functions of safety equipment. The operator must make a planned, continuing effort to eliminate accidents which shall include the training of personnel in the operations aspects of their functions and a program to instill in each individual working offshore a conscious desire to achieve safe and pollution-free operations.

Gulf of Mexico OCS Order No. 9

Order No. 9 provides approval procedures for oil and gas pipelines. This includes the purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline are to be monitored, as is the installation of connecting facilities. A hydrostatic test to greater than the design working pressure of the line will be made upon completion of installation.

The effect of this Order is to greatly reduce the chance for offshore oil spills or gas leaks as discussed in Section III. The approval of pipeline routes by the USGS as well as BLM and the Department of Transportation (described elsewhere) can effectively reduce a variety of impacts to marine biota and multiple uses of the Gulf of Mexico OCS.

Gulf of Mexico OCS Order No. 10

Order No. 10 establishes sulphur drilling procedures. The order is basically the same as OCS Order No. 2 except for a few variations.

The distance that the conductor casing is installed is not to exceed a depth of less than 107 m (350 ft) nor more than 229 m (750 ft) below the Gulf floor.

The caprock casing shall be set at the top of the caprock and be cemented with a quantity of cement to fill the annular space back to the Gulf floor.

A bag-type blow-out preventer shall be tested to 70% of the noted working pressure of the stack assembly. It shall be actuated on the drill once each week. Accumulators and accumulator pumps shall maintain a pressure capacity reserve at all times to provide for repeated operation of hydraulic preventors.

Gulf of Mexico OCS Order No. 11

This Order provides for the prevention of waste, conservation of oil and gas, and protection of correlative rights. Enhanced recovery of all oil and gas from a lease is required and production rates of oil and gas are established. Each operator shall produce without waste his proper share of oil and gas from a common source of supply. Production procedures to be followed in the eventuality of shut-ins for overproduction or storms are set forth as are the requirements for all tests of well productivity. Requirements concerning the location of all wells are given as are the ability of the Supervisor to decide issues on field unitization. This Order provides a means to insure proper production of oil and gas placement of facilities to maximize production while minimizing environmental impact.

Gulf of Mexico OCS Order No. 12

This Order sets forth requirements for public availability of data and records concerning offshore petroleum operations. Proprietary geological and geophysical interpretations, maps, and data required to be submitted are not available for public inspection. Certain records pertaining to leases and wells are made available for public inspection such as: Monthly Report of Operations; Well Completion or Recompletion Reports and Log; Sundry Notices and Reports on Wells; Application for Permit to Drill, Deepen or Plug Back; Quarterly Well Test Reports; Semiannual Gas Well Test Reports; Multipoint Back

Pressure Test Report; Sales of Lease Production; and Inspection Records.

GULF OF MEXICO OCS ORDER NO. 13

Order No. 13 requires the accurate measurement of oil and gas production and sets forth stipulations under which production from several wells can be commingled. This Order will offset any possible attempts of fraud and alleviate public concern that operators are underestimating royalties due the Federal government.

GULF OF MEXICO OCS ORDER NO. 14

Order No. 14 will assure diligence in the development of OCS natural resources by allowing limited suspensions of operations or production while the operator is waiting for installation of equipment or granting of permits necessary for transportation of oil and gas from a lease. Criteria will be set under which suspensions can be granted and will provide a means to determine if production is being withheld for purposes other than as stated.

PROPOSED GULF OF MEXICO OCS ORDER NO. 15

Order No. 15 on the submittal of information for development plans, pursuant to the new requirements established in 30 CFR 250.34 in November 1975, will detail the required data contents and the review process to be followed before the Supervisor grants approval of the development plan(s) of each lessee. The lessee will submit the information to the directly affected states concerning information on the proposed onshore and offshore facilities anticipated for development. This information may be submitted simultaneously to the States with the formal development plan(s).

There is presently a Task Force consisting of Department of the Interior personnel and representatives from each of the five regions of the OCS Advisory Board, which is working on more detailed guidelines for this Order. The proposed OCS Order No. 15 was published in the Federal Register on October 20, 1976 (Vol. 41, No. 204, pages 46355-46357).

2. Inspection Programs and Approval Requirements

To enforce the Geological Survey Operating Regulations (30 CFR 250) and OCS Orders, a comprehensive inspection system has been developed. OCS operators must receive approval before commencing any work. Operators are required to submit a notice and detailed description of work they desire to perform to the USGS District Supervisor and to the Governor of the adjacent state (persuant to 30 CFR 250.34 and the above proposed OCS Order No. 15). This requirement is to insure that no operation is conducted without thorough planning for safety, conservation, and protection of the environment, and to determine that all operations meet the standards established by regulations and OCS Orders, and to assure proper coordination with affected states.

A. ON-SITE INSPECTION

All operations, regardless of the activity, will receive regular on-site inspection for compliance with regulations and OCS Orders. The Geological Survey uses a systematic program including both scheduled and unannounced inspections to assure the achievement of safety objectives. Floating drilling vessels or drilling units will receive a detailed inspection to insure conformance with regulations and OCS Orders before commencement of drilling operations. These predrilling inspections are comprehensive and often require several days to complete. Also, these rigs will be inspected at least once during the drilling of a well, and all well control, safety, and pollution control equipment will be inspected for proper function.

Permission to either abandon or suspended a well must be granted by the USGS; this includes the setting of all required cement plugs, the cutting of the several casing strings below the sea floor at which the casing is removed will be reviewed by the USGS on a case-by-case basis to ensure that sediment migration will not eventually expose the casing stub.

Well workover and well abandonment phases of OCS operations, as with drilling, will receive both scheduled and unscheduled inspections, depending on the progress of a particular operation. Drill stem testing, cement plugs set prior to redrilling a well, cement plugs set to temporarily or permanently abandon a well, and all casing cementing operations must be approved by the USGS Supervisor.

OCS pipelines will be installed in accordance with the Gulf of Mexico OCS Order No. 9, which will provide for submittal of information such as purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline are monitored, as is the installation of connecting facilities. A hydrostatic test to greater than the designed working pressure of the line is made upon completion of installation.

b. Inspection Schedule and Enforcement

The inspection program for the Gulf of Mexico OCS area is maintained by the U.S. Geological Survey with the intent that required regulations will be followed to avoid potential hazards to personnel, provide protection for the environment, and preserve the multiple-use concept to the OCS lands. Warnings for incidents of noncompliance are issued and the date of correction of defects are recorded.

Visual inspections of the water surface over OCS pipelines in the Gulf of Mexico operating area are currently made by the operator for evidence of failures and leaks. USGS and operator personnel in this area visit production facilities daily and follow a route approximating the pipeline route.

The U.S. Coast Guard also patrols for oil spills or leaks with vessels and aircraft.

An approved contingency plan is required from each operator in the Gulf of Mexico that includes spill control, containment and cleanup, and measures to be taken if there is any likelihood that hydrogen sulfide gas might be encountered during the drilling operation.

c. Inspection Procedures for Subsea Systems

Subsea systems may possibly be used to produce oil and gas resulting from this proposed sale. Inspections of these systems in the Gulf of Mexico will be in accordance with the OCS Orders. Order No. 1 requires the surface marking of all such systems in accordance with guidelines developed by the USGS Supervisor.

The many Federal agencies involved in the review process of subsea systems include, in addition to the Geological Survey: EPA, Coast Guard, Corps of Engineers, U.S. Fish and Wildlife Service, and the Bureau of Land Management. Except for proprietary parts, plans for exploration and development utilization are available for general public review (See I.G.1).

d. Operator reports

A comprehensive reporting system covering all oil spills and any unusual conditions (for example, reporting and investigation of a persistent oil slick from an unknown source, such as a sunken ship or natural oil seep) is required by the OCS Orders, and is a key factor in monitoring operations in the Gulf of Mexico. Operators are also required to maintain records for inspection by the Geological Survey of required periodic tests of safety equipment. A digest of these reports and the various forms that are required can be found in the Gulf of Mexico OCS Order No. 12, Appendix B.

3. Enforcement

The USGS policy is intended to eliminate any noncompliance with lease requirements by the operator that may lead to loss of life, loss of property and resources, or damage to the environment. A standardized compilation of items has been prepared by the USGS, entitled "List of Potential Items of Noncompliance and Enforcement Action" the "PINC" list, which is used for inspection. Should an inspection of drilling and production operations detect hazard pressure situations or pollution, either a written warning will be given that allows the operator seven days to correct the incident of noncompliance (INC), or a shut-in order will be issued. The shut-in order may be applied only to the equipment affected by the incident of noncompliance such as a particular piece of production equipment or a producing zone, or to the entire drilling rig, production platform, or onshore facility, as required.

Additional penalties for noncompliance are specified in Section 5(a)(2) of the Outer Continental Shelf Lands Act of 1953, 43 U.S.C. Sec. 1334(a)(2).

> Any person who knowingly and willfully violates any rule or regulation prescribed by the Secretary for the prevention of waste, the conservation of natural resources, or the protection of correlative rights shall be deemed guilty of a misdemeanor and punishment by a fine of not more than $2,000 or by imprisonment, and each day of the violation shall be deemed a separate offense.

Also,. Sections 5(b) and 5(b)(2) provide for cancellation by notice of nonproducing leases subject to judicial review or appropriate judicial proceedings.

The total number of warnings issued and suspensions ordered for infractions of OCS Orders which occurred during normal daily inspections from December 1, 1972 through May 31, 1976 are as follows:

Warnings:	
Drilling	83
Workover	17
Production	5,856
Suspensions:	
Drilling	53
Workover	6
Production	4,445

During the period of February 1, 1976 through May 31, 1976 there were 18 oil spills of more than 13 barrels reported, three of which are described below:

1. A transfer hose from a boat to a platform ruptured allowing 14 barrels of diesel fuel to spill.
2. Several leaks occurred in an 18-inch gathering line, allowing 414 barrels of crude oil to spill.
3. Fifteen barrels of oil spilled when a compartment in a barge developed a leak.

In accord with prescribed inspection procedures, Geological Survey personnel verified that remedial action had been taken in all reported spill incidents prior to the reactivation of the production facilities.

A program of intensive inspections is used on OCS leasing. Inspections are conducted on a regular basis with emphasis placed on operations. Periodically, all available inspectors devote a week to a special inspection, where production platforms and drilling wells are inspected on a random basis. The Geological Survey inspection force in the Gulf of Mexico has increased from seven technicians and five engineers as of July 1, 1969, to 42 technicians and 16 engineers as of May 31, 1976. During the period November 1, 1972 through May 31, 1976, technicians spent 17,005 inspection days or 149,015 man-hours, and engineers 1,671 inspection days or 14,563 man-hours in the field. Detailed inspections were conducted on 4,944 major producing platforms and 3,375 minor platforms in the Gulf of Mexico from December 1, 1972 through May 31, 1976. Also, during this time period, 2,904 inspections of single-wells or satellites were made by boat. Approximately 95% of these inspections were unannounced. Included in these inspections were 53,885 well completions. Also, during this time period, 5,820 inspections of drilling rigs were conducted. There is no absolute measure of the significance of these data per reporting period. However, it is apparent that inspections have increased considerably per period since 1972.

Minor incidents of non-compliance result in formal warnings while incidents on non-compliance of a potentially more hazardous nature result in well or platform shut-ins until the operation is in full compliance with regulations and orders.

Tables IV-1, IV-2, and IV-3 indicate equipment malfunctions detected during inspection and enforcement actions over three separate periods. These data include only the results of special inspections and are limited to the most frequent malfunctions detected.

These tables indicate specific items found to be in non-compliance during special inspections. Basic pollution control items or production equipment in which malfunctions were detected for the time period are identified. Listed in the third column are the number of items which did not operate within acceptable tolerances. These items did not fail or cause an undersirable event.

Velocity type subsurface safety valves are periodically pulled from the wells and checked. This requires removing the valve from the well for inspection, repair, adjustment and reinstallations. One company utilizes test stands to test the valve performance characteristics under simulated flow and pressure conditions. Surface operated subsurface safety valves are tested in place by releasing hydraulic pressure within the closed system thereby closing the valve; subsequently, the valve is reopened by repressuring the system. An average reporting period from February through April 1975 resulted in approximately 3,000 subsurface safety valves being checked. Of this amount, 174 failed components were detected in the valves, with a number of the valves having more than one failed component.

Nine companies were fined a total of $2,358,000 in District Court for failure to install subsurface safety devices in offshore oil wells during 1970 in the Gulf of Mexico.

Experienced private and government personnel are aware that public attention was focused on the oil spill at Santa Barbara in January 1969, and probably because of this awareness, there has been a great deal less oil pollution in the Gulf as a result of normal oil and gas producing operations. Table IV-4 summarizes the oil spills in the Gulf during the spring of 1976.

In the past, major events were cataloged while less serious events were often not reported. Some years ago, wells were on occasion intentionally flowed into the water for short periods during clean-up operations. Now, sophisticated burning devices are designed to consume this well clean-up oil without producing air or water pollution.

Table IV-1 - Equipment malfunction detected January through November 1972 special inspections.

	No. checked	Operable	Inoperable or not within acceptable tolerances	Percent failure
Surface safety valves. . .	1,533	1,480	53	3.5
Flowline sensors	3,021	2,982	39	1.3
Check valves	1,434	1,370	64	4.5
Pressure vessels:				
High pressure sensors. .	961	942	19	2.0
Low pressure sensors . .	610	600	10	1.6
High level shut-in . . .	351	345	6	1.7
Low level shut-in. . . .	323	314	9	2.8
Total.	8,233	8,033	200	2.4

Table IV-2 - Equipment malfunctions detected January through November 1973 special inspections.

	No. checked	Operable	Inoperable or not within acceptable tolerances	Percent failure
Surface safety valves. . .	1,492	1,423	69	4.6
Flowline sensors	1,327	1,290	37	2.8
Check valves	1,469	1,385	84	5.7
Pressure vessels:				
High pressure sensors. .	1,100	1,077	23	2.1
Low pressure sensors . .	784	771	13	1.7
High level shut-in . . .	405	398	7	1.7
Low level shut-in. . . .	383	375	8	2.1
Total.	6,960	6,719	241	3.5

Source: U.S. Geological Survey, 1975.

Table IV-3 Equipment malfunctions detected during complete and partial inspections January 1, 1971-May 31, 1976

	No. checked	Operable	Inoperable or not within acceptable tolerances	Percent failure
Surface safety valves. . .	12,898	12,522	376	2.8
Flowline sensors	25,253	24,960	293	1.2
Check valves	11,882	11,173	709	5.8
Pressure vessels:				
High pressure sensors. .	10,393	10,077	316	3.0
Low pressure sensors . .	8,341	8,155	186	2.2
High level shut-in . . .	8,821	8,576	245	2.8
Low level shut-in. . . .	5,229	4,997	232	4.3
TOTAL	82,817	80,460	2,357	2.8

Source: Geological Survey, Metarie, Louisiana (August, 1976).

Table IV-4 Summary of oil slicks and oil spills information which occurred from February 1, 1976 through May 31, 1976 is summarized below.

Month	No. spills	Vol. crude (barrels)	Vol. other	No. spills one barrel or less	No. slicks sighted
February 76	7	35	-------	81	38
March 76	5	13	-------	60	45
April 76	3	24	14 diesel	84	44
May 76	3	421	-------	52	26
TOTAL	18	493	14 diesel	277	153
Total since November 1972	456	46,205	62 condensate 645 diesel 47 oil base mud 3 distillate 10 corrosion inhibitor 2 methanol	1,987	2,055

Source: Geological Survey, Metairie, Louisiana (August, 1976).

Automatic equipment is now in use which shuts down production whenever a leak occurs in pipeline or production facilities. These include, but are not limited to, pressure sensors and high and low level controls. Drip pans are placed under valves, vessels and the production system in order to prevent leaking oil from escaping into the waters of the Gulf.

During the past four years, the average number of pipeline malfunctions which resulted in oil spillage was approximately 20 per year, with 30 occurring during 1974. This apparent increase may be attributed to: increased inspections and better reporting; increased footage of pipelines; age of existing pipelines; and damage by tropical storms (personal communication, USGS, 1975).

From January 1, 1971 through May 31, 1976 there were approximately 50,000 barrels of oil produced per each barrel of oil spilled.

4. Oil Spill Contingency Action

Oil spills will occasionally occur as a result of natural disasters, equipment failure or human error. In the event that such an emergency occurs, the following action will be taken:

a. REQUIREMENTS OF OCS ORDER NO. 7

In any case of any spill, the operator is required to initiate action to control and remove the oil pollution in accordance with his approved emergency plan. In any case, a spill or leakage of less than 15 barrels requires a report from the operator to the Supervisor as to the nature of the spill or leakage, the reason for its occurrence and what steps were taken to correct it. A spill of 15-50 barrels must be reported immediately to USGS by telephone and confirmed in writing. A spill of over 50 barrels or one of any magnitude that cannot be immediately controlled must be reported immediately to the Coast Guard, the Environmental Protection Agency and the Geological Survey.

b. REGIONAL AND NATIONAL CONTINGENCY PLANS

If the operator should be unable to control and remove the pollution, the Regional or National Oil Hazardous Substances Pollution Contingency Plan may be activated and the designated Federal On-Scene Coordinator would direct control and clean-up operations at the operator's expense. This has never been necessary to date in the case of any spill from OCS operations.

The Regional or National Oil and Hazardous Substances Pollution Contingency Plan was developed pursuant to the provisions of the Federal Water Pollution Control Act as amended (33 U.S.C. 1101). The Council on Environmental Quality has published the revised National Oil and Hazardous Substance Contingency Plan as required by the Federal Water Pollution Control Act Amendments of 1972. Section 11 (c)(2) of that statute authorized the President, within sixty days after the sections became effective, to prepare and publish such a Plan. The Plan provided for efficient, coordinated and effective action to minimize damage from oil (and other) discharges, including containment, dispersal and removal. The Plan includes: assignment of duties and responsibilities; identification, procurement, maintenance and storage of equipment and supplies; establishment of a strike force and emergency task force; a system of surveillance and notice; establishment of a national center to coordinate response operations; procedures and techniques to be employed in identifying, containing, dispersing and removing oil; and a schedule identifying dispersants and other chemicals that may be used in carrying out the Plan and the waters and quantities in which they may be safely used. Annex X of the Plan basically sets forth a no dispersant policy. Exceptions can be made for safety reasons (to prevent fire or explosions) or for certain other circumstances such as the protection of endangered waterfowl. However, the approval of EPA is required, except in cases of safety when the approval of the On-Scene Coordinator is required. The Plan is revised from time to time as necessary. Operation of the National Contingency Plan requires a nationwide network of regional contingency plans. Guidelines for that nationwide network are established in the National Plan. This Plan provides for a pattern of coordinated and integrated responses of departments and agencies of the Federal Government to pollution spills. It establishes a nationwide response team and provides guidelines for the establishment of regional contingency plans and the response teams. The Plan also promotes the coordination and direction of Federal, State and local response systems and encourages the development of local government and private capabilities to handle such pollution spills.

The objectives of the Plan are: to develop appropriate preventive and preparedness measures for discovering and reporting the existence of a pollution spill; to promptly institute measures to restrict further spread of the pollutant; to assure that the public health, welfare and natural resources are provided adequate protection; to provide for the application of techniques for clean-up and disposal of the collected pollutants; to provide strike forces of trained personnel and adequate equipment to polluting spills, to institute actions to recover clean-up cost; and to effect enforcement of existing Federal statutes and regulations issued thereunder. Detailed guidance is contained in the basic Plan, the annexed and the regional plans.

The Plan is effective for all U.S. navigable waters including inland rivers, the Great Lakes, coastal territorial waters and the contiguous zone and high seas beyond this zone where a threat exists to U.S. waters, shore-face or shelf-bottom. Its provisions are applicable to all Federal agencies.

A memorandum of understanding between the Department of the Interior and the Department of Transportation outlines the respective responsibilities of the Geological Survey and the Coast Guard under the National Contingency Plan. The Geological Survey is responsible for the coordination and direction of measures to abate the source of pollution when the source is an oil, gas or sulphur well. This responsibility includes the authority to determine whether pollution control operations within a 500 m radius of the pollution source should be suspended to facilitate measures to abate the source of pollution. The Coast Guard is responsible for the coordination and direction of measures to contain and remove pollutants, and shall furnish or provide the On-Scene Coordinator with authority and responsibilities as provided by the National Contingency Plan. The Gulf of Mexico Strike Force Team in Bay St. Louis, Miss. may also respond to any pollution emergency.

c. Petroleum Industry Contingency Plan

Inventory of known resources available for emergency oil spill control and clean-up

From the upper Texas coast to the Mississippi Delta region offshore operators maintain a large inventory of various kinds of equipment that could be put to use on short notice for containing and cleaning up an oil spill and stopping the source of the spill. This inventory includes 177 boats ranging from 30 crewboats to 50 m utility and cargo vessels, 64 helicopters, and 103 fixed-wing aircraft. For a complete inventory of oil spill containment and clean-up equipment see USDI, BLM, 1975, Sale 41, Appendix C.

Clean Gulf Associates

Clean Gulf Associates ia a non-profit organization formed by thirty-nine companies (these companies produce 98% of offshore petroleum) operating in the OCS. Their purpose is to provide for a stockpile of oil spill containment and clean-up materials for use by member companies in offshore and estuarine areas. Clean Gulf Associates has contracted, effective August 1, 1972, with Halliburton Services to supply equipment, materials and personnel necessary to contain and clean-up spills in the Gulf of Mexico to the limits of the OCS lying offshore and seaward of the states of Texas, Louisiana, Mississippi, Alabama and Florida.

All of the tracts considered in this proposal fall within this area. Before any drilling commences, should this proposed sale be held, an inventory of pollution combatting equipment would be stockpiled at a strategic location. Spill booms, skimmers, vacuums, sprayers and absorbents are examples of equipment stockpiled.

At the present time clean-up systems are maintained at five primary bases located at Mississippi River Delta, Grande Isle-LaFourche-Terrebonne, Morgan City-Atchafalaya, Vermilion-Cameron and the Texas coast.

These systems include: fast response open sea/bay, high volume open sea, and shallow water skimmer systems and auxiliary shallow water and beach clean-up equipment.

d. Effectiveness of Clean-up Operations

The effectiveness of offshore clean-up is contingent upon weather. The equipment which is now stockpiled and available as well as that which will be built in the near future, is not completely effective in high winds or waves. The more accessible and consolidated the pollutants the more effective the containment and removal equipment. The average recovery of oil spilled at sea is on the order of 20% (Biglane, 1975).

A major problem of spill clean-up operations involves the disposal of oil contaminated debris. If a spill involves a large quantity of such debris, an acceptable disposal site must be found. The residents of shore communities are becoming increasingly reluctant to commit their disposal sites, which are of limited capacity, to this use. If the debris is not disposed of properly, secondary contamination of surface or ground waters can result.

B. Structures

If a ship strays from established safety fairways, oil and gas platforms can pose a hazard to commercial shipping. This hazard however, is minimized by the fact that safety fairways are clearly designated on navigation charts. Directional drilling from outside safety lanes is used to develop tracts lying partially under safety lanes. Pertinent portions of the Federal Regulations (33 CFR Sec. 209.135(b), 1971) governing shipping fairways and anchorage areas are as follows:

> "The Department of the Army will grant no permits for the erection of structures in the area designated as fairways, since structures located therein would constitute obstructions to navigation. The Department of the Army will grant permits for the erection of structures within an area designated as an anchorage area, but the number of structures will be limited by spacing as follows: The center of a structure to be erected shall be not less than two (2) nautical miles from the center of any existing structures. In a drilling or production complex, associated structures shall be as close together as practicable having the consideration for the safety factors involved. A complex of associated structures, when connected by walkways, shall be considered one structures for the purposes of spacing. A vessel fixed in place by moorings and used in conjunction with the associated structures of a drilling or production complex, shall be considered as attendant vessel and its extent shall include its moorings. When a drilling or production complex includes an attendant vessel and the complex extends more than five hundred (500) yards from the center of the complex, a structure to be erected shall not be closer than two (2) nautical miles from the near outer limit of the complex. An underwater completion installation in an anchorage area shall be considered a structure and shall be marked with lighted buoy as approved by the United States Coast Guard."

Development of those tracts in the proposed sale which lie partially within shipping fairways or anchorage areas will be subject, if leased, to Federal regulations as presented above so far as the placement of structures is concerned. This would help mitigate any potential impact due to the proximity of structures to relatively high frequency sea traffic. Visual No. 1 depicts offered tracts and fairways.

Commercial vessels are required to report to the Coast Guard whenever a casualty results in any of the following: actual physical damage to property in excess of $1,500, material damage effecting the sea-worthiness or efficiency of a vessel, stranding or grounding, loss of life or injury causing any person to remain incapacitated for a period in excess of 72 hours except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty. Drilling and production platforms (artificial islands) are required to report to the Coast Guard when involved in a casualty or accident and if any of the following occur: if hit by a vessel and damage to property exceed $1,500, damage to fixed structure exceeds $25,000, material damage affecting usefulness of lifesaving or fire fighting equipment or loss of life.

Under some conditions, offshore structures are an obstacle to commercial fishing activities. Depending on currents and underwater obstacles an offshore structure can remove areas of trawling and purse seining waters. Heavy concentrations of platforms can make trawling and purse seining difficult.

The erection of more structures on the OCS may affect commercial fishing operations. The impact from platforms may be kept to a minimum by allowing only those structures necessary for proper development and production of the mineral resources, and by placing them with due regard to fishing operations and other competing uses which are evident at the time of platform approval.

The Area Oil and Gas Supervisor considers the views of commercial fishing organizations such as the Gulf States Marine Fisheries Committee with regard to placement of platforms. The Supervisor also from time to time requests information from the Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service to be used in his decision making process of approving or disapproving platform installation. Within the constraints of location of the reservoirs and the technology necessary to drill directional wells, the Supervisor is mindful that platform location is an important consideration for commercial fisheries and does make decisions regarding platform location which minimize the impact on the commercial fishing industry.

In an effort to further mitigate the impact of offshore structure resulting from this proposed sale with regard to commercial fishing and other significant existing or future uses of the leased area, a lease stipulation controlling the placement of structures will be applied to all blocks in this proposed offering in the event they are leased (see Section IV.D.1.d.).

C. Pipelines

1. Existing Responsibilities

Federal responsibility and authority for gas and oil pipeline routing or operation on submerged coastal lands is vested in a number of agencies, including the following: Department of the Interior, Bureau of Land Management - rights-of-way for pipelines on the OCS, environmental review and recommendations to the U.S. Geological Survey for all gathering and flowlines; Geological Survey - jurisdiction over producer owned gathering lines and flow-lines on the OCS; U.S. Fish and Wildlife Service - protection of fish and wildlife resources and their habitat through consultation with the Corps of Engineers in the process of issuing Federal permits in navigable waters. U.S. Army Corps of Engineers - issues permits for construction (including pipelines) on OCS and in other navigable waters; Federal Power Commission - grants ''certificates of convenience and necessity'' prior to construction of interstate natural gas pipelines; Interstate Commerce Commission - grants approval of the tariff rates for transportation of oil by common-carrier pipelines; Department of Transportation, Office of Pipeline Safety Operations in the Materials Transportation Bureau - establishes minimum standards for pipeline construction, operation and maintenance; and Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service - protection of marine fishery resources and their habitat (in coordination with the U.S. Fish and Wildlife Service) through consultation with the Corps of Engineers in the process of issuing Federal permits in navigable waters.

At present, the cooperative effort between the Department of the Interior and the Corps of Engineers, and the National Marine Fisheries Service and State conservation agencies is responsible for minimizing the impact of pipeline and other construction in navigable waters and adjacent and contiguous wetlands of the U.S.

The regulatory functions of the U.S. Corps of Engineers cover structures and work in or affecting navigable waters of the United States, the discharges of dredged or fill material into navigable waters, and the transportation of dredged material for the purpose of dumping into ocean waters. The scope of these regulatory functions is currently defined under Title 33, Code of Federal Regulations, Part 209, Permits for Activities in Navigable Waters or Ocean Waters, as published in the ''Federal Register'' on 25 July 1975.

The Environmental Protection Agency reviews and comments on dredging projects in navigable waters in accordance with a memorandum of understanding with the Corps of Engineers dated July 13, 1967.

The National Oceanic and Atmospheric Administration (through its National Marine Fisheries Service) has been vested with responsibility for participating in matters relating to marine and estuarine areas. The NMFS has responsibility and authority under several statutes including the Fish and Wildlife Coordination Act, as amended; the Fish and Wildlife Act of 1956; and the Fishery Management and Conservation Act of 1976. The NMFS, in coordination with the appropriate State and Federal agencies reviews all applications to the Corps of Engineers for permits to construct pipelines in navigable waters within the State boundaries and assesses their potential impact on fishery resources and the environment.

The Department of the Interior and its U.S. Fish and Wildlife Service has responsibility and authority under several statutes, including the Fish and Wildlife Act of 1956, the Estuary Protection Act, the Endangered Species Act of 1973, the Migratory Bird Conservation Act, the Fish and Wildlife Coordination Act, the Marine Mammals Protection Act, and various international treaties enacted to preserve, conserve, protect and enhance fish and wildlife resources and their habitat.

The U.S. Fish and Wildlife Service, with assistance from appropriate State and Federal agencies, including the National Marine Fisheries Service now reviews all applications to the Corps of Engineers for permits to construct pipelines in navigable waters and assesses their potential impact on fish and wildlife resources and the environment. When appropriate, the FWS recommends to the Corps specific modification of project plans which are needed to reduce impact on these resources. Occasionally a project plan is so conceived that significant impact cannot be avoided and at the same time, a satisfactory alternative may not be available; in such cases, a recommendation that the permit not be issued would be appropriate.

2. Mitigating Measures

Federal, State or local authorities or private landowners may take measures to require depending upon circumstances and location, that pipelines be buried; that archaeological and hazard surveys be conducted; that canals in wetland areas be backfilled where possible; that bulkheads be erected and maintained in marsh areas to prevent saltwater intrusion; that specific types of dredging equipment be used and specific methods for placement or disposal of spoil be required; that beach and dune areas crossed by pipelines be restored; that pipeline installations in sensitive or vulnerable areas be seasonally timed so as to occur, for example, during low periods of tourist and recreational activities, or prohibited during acute periods of nesting of waterfowl or migrations of fish and wildlife.

The Department of the Interior will ultimately receive applications for the OCS component of pipelines resulting from this proposed sale, and after considering all factors, may approve pipeline rights-of-way. The procedure for this is outlined in a Memorandum of Understanding between the Bureau of Land Management and the Geological Survey for Outer Continental Shelf Pipelines. The purposes of the Memorandum is to clearly define the administrative and operational roles of the Bureau of Land Management and the U.S. Geological Survey relating to pipelines on the OCS, to provide consistent and standardized procedures, and to minimize or eliminate dual and overlapping functions. The objectives of the Memorandum are to:

Provide an efficient mechanism for approving pipeline routes through the submerged lands of the OCS.

Initiate measures to provide safety and to minimize or eliminate environmental damage which may be associated with the installation and operation of pipelines originating on the OCS.

Be responsive to the interests of the oil and gas industry, other users of the OCS, and the public with respect to pipelines.

Streamline implementation of the regulations and procedures for more efficient and uniform administration of the Department's authority with respect to pipelines.

The Bureau of Land Management's role in pipeline management on the OCS is defined as follows:

Conduct pipeline routing studies and, with the concurrence of the USGS, designate pipeline corridors on the OCS for all pipelines other than flow or gathering lines within the confines of a single lease or group of contiguous leases under unitized operation or a single operator.

Maintain a central office of record for the locations of all existing and future pipelines as specified in paragraph I.A. and associated structures on the OCS.

Prepare environmental assessments, pipeline system planning studies, economic studies, and environmental impact statements when necessary or appropriate, prior to approving applications for rights-of-way pursuant to 43 U.S.C. 1-34(c) and 43 CFR 2883.

Receive applications for rights-of-way for pipelines to be installed on the OCS pursuant to 43 U.S.C. 1334(c) and 43 CFR 2883.

After considering the potential impact of the pipelines on the environment, the relationship of the application to existing pipeline routes on the OCS, and other factors approve or disapprove the application pursuant to 43 CFR 2883.

This memorandum notwithstanding, some potential adverse effect related to OCS induced pipeline sitings occur nearshore and onshore and generally remain outside BLM authority to apply direct mitigatory measures. However, the ability to regulate pipelines on the OCS implies certain influence over the allocation of nearshore and onshore resources. This ability represents a management tool with the potential to indirectly mitigate many adverse effects of random pipeline placement in areas beyond BLM authority. The ability to structure one component of a total transportation system permits a greater degree of departmental management, control and environmental responsiveness of Federal, industry and State expressions of pipeline requirements and siting policy; offshore and onshore are integrated during pre-planning stages.

The Department plans to optimally structure sale-related pipeline development and locational schemes for tracts that may be leased in this proposed sale as per BLM responsibility for pipeline system planning on the OCS. Optimum pipeline development is partly a function of offshore and onshore environmental capabilities, operational and economic needs and the transportation needs of the impacted area. Recognition of these parameters in a coordinated Federal, State and industry effort will result in pipeline sitings which recognize zones of lease environmental impact and which are economically feasible, according to articulated studies, plans, policies and controls. Such an effort is anticipated before the granting of any pipeline right-of-way that may be induced by this proposed sale.

D. Special Stipulations

Leases for oil and gas exploration and development are subject to all OCS operating orders and regulations. Additionally, in some cases, leases offered in a particular OCS lease sale include special stipulations for added protection of a particular resource or activity.

For this proposed sale, lease stipulations will be recommended to the Secretary of the Interior to provide for the protection of human, biological and cultural resources while allowing the orderly development of the oil and gas resources in the Gulf of Mexico OCS.

The following stipulations are proposed to be included in some or all leases issued, as indicated below:

Stipulation No. 1 Cultural Resource Stipulation (To be included in all leases resulting from this proposed sale).

The lessee shall conduct a remote sensing and/or other survey as specified by the Supervisor on the recommendation of the Manager, New Orleans OCS Office, Bureau of Land Management, to determine the possible existence of a cultural resource that may be affected by the lessee's operation. The lessee's report shall document through the use of a qualified marine survey archaeologist's analysis of all survey data (including magnetometer and side scan records), all indications of objects, on or directly below the seabottom, which may be historic shipwrecks or which may have been the locations of early man living sites. This report shall be submitted to the Supervisor and the Manager for review. If the Supervisor, after consultation with the Manager, determines that a potential cultural resource might be affected by proposed operations, the lessee shall either: (a) locate the site of any operation so as not to adversely affect the potential cultural resource identified, or (b) determine, to the satisfaction of the Supervisor, on the basis of further investigation conducted by a qualified marine archaeologist or marine survey archaeologist that such operations will not adversely affect the potential cultural resource identified, or that the object is not a cultural resource.

The lessee shall take no action that may result in an adverse effect on the cultural resource until the Supervisor has given directions as to its disposition.

If the presence of a cultural resource has ben confirmed and it cannot be avoided, the lessee shall mitigate, under supervision of a qualified marine archaeologist, the adverse effect, as directed by the Supervisor.

If any site, structure, or object of cultural resource significance should be discovered during the conduct of any operations related to the leased area, the lessee shall make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its disposition.

Stipulation No. 2 Biological Resources Stipulation

a. (To be included only in the lease resulting from this sale for tract 55 (NE¼ only)):

All drill cuttings and drilling fluids must be disposed of by shunting the material to the bottom through a downpipe that terminates an appropriate distance, but no more than 10 meters, from the bottom.

b. (To be inculded only in the lease resulting from this sale for tract 50.)

No structures, drilling rigs, or pipelines will be allowed within the aliquots established for the East Flower Garden Bank:

East Flower Garden Bank

Tract 45050 (High Island Area, East Addition, South Extension A-374) NW¼SW¼NW¼; S½SW¼NW¼; W½SW¼; SW¼NE¼SW¼; NW¼SE¼SW¼; S½SE¼SW¼

Exploration and development operations are permitted within the circle outside the above aliquots with radius of 20,064 feet around point P which is located by X = 3,742,875, Y = 71,280 (Texas Lambert System), with the following restrictions:

All drill cuttings and drilling fluids must be disposed of by shunting the material to the bottom through a downpipe that terminates an appropriate distance, but no more than 10 meters, from the bottom; however, if the shunting method is not adequate to protect the unique character of the subject area, then the material must be transported a minimum of 10 miles from any 25 fathom isobath surrounding live reef-building coral before disposal. Disposal sites must be approved by the Supervisor.

No garbage, untreated sewage, or other solid waste shall be disposed from vessels (work-boats, crew-boats, supply boats, pipe-laying vessels) during exploration and development operations within the area of the bank described above for exploration and development operations.

No drilling permits will be issued by the Supervisor until he has found that the lessee's exploration and development plan filed under 30 CFR 250.34 is adequate to insure that exploration and production operations in the leased area will have no significant adverse effect on the biotic communities associated with the high value reef sites on the Flower Garden Banks. As a part of the development plan, a reef monitoring program must be included.

The monitoring program will be designed to assess the effects of oil and gas exploration and development operations on the viability of the coral reefs and associated communities. The development plan should indicate that the monitoring program will be conducted by qualified independent scientific personnel and that program personnel and equipment will be available at the time of operations. The monitoring team will submit its findings to the Regional Director, Fish & Wildlife Service; the Manager, New Orleans OCS Office, Bureau of Land Management; and the Supervisor on an interim on-going basis, or immediately in case of imminent danger to the reefs resulting directly from drilling or other operations.

(To be included only in the leases resulting from this sale for tracts 50 and 55.)

Maps showing an interpretation of the bathymetry and geologic and engineering hazards (e.g., shallow gas, geopressure, sediment stability, fractures and/or such dangers that could destroy platforms or drilling rigs and thereby harm the biota) shall be prepared and submitted to the Manager, New Orleans Outer Continental Shelf Office for his review prior to the commencement of any drilling activities.

d. (To be included in all leases resulting from this sale.)

If the rates, amounts, and types or combination of drill cuttings and fluids utilized in the subject tracts are determined to be harmful to biota associated with those tracts, then the Supervisor, at the request of the Manager, New Orleans OCS Office and the Regional Director, U.S. Fish and Wildlife Service, will impose appropriate limitations or restrictions to minimize or eliminate deleterious effects.

E. Other Mitigating Measures

1. Notices to Lessees and Operators

These notices have the same effect or status as OCS Operating Orders and Regulations and are used when expeditious clarifications or corrections and additions to existing orders and regulations are necessary. By issuing Notices to Lessees and Operators, the extensive amount of time necessary to amend and republish orders and regulations is avoided. An example of a Notice to Lessees and Operators is found in Appendix C.

2. Departures

A departure (waiver) from OCS orders or other rules of the U.S. Geological Survey, may be granted by the Supervisor when such a departure is determined to be necessary for (30 CFR 250.12(b)): the proper control of a well, conservation of natural resources, protection of aquatic life, protection of human health and safety, protection of property or protection of the environment.

Waivers are technically based decisions and are granted only in situations in which expert judgment determines that better and safer operations would result from operations under the waiver.

3. Research on Advanced Technology

The EPA and the Coast Guard are conducting research on more efficient containment and recovery devices (booms and skimmers). The efficiency of booms and skimmers depends upon sea state and spill conditions but in any case they are never 100% efficient.

When the results of these studies and any other similar studies so indicate, the requirement for use of bettern techniques and equipment will be incorporated into the OCS regulations and orders as appropriate. If incorporated, the requirements will be applied to all leases.

4. Geophysical Information

The Conservation Division of the Geological Survey is aware of near-surface structural configurations and its effect on drilling, fixed-structural emplacement, pipelines, etc., in relation to the proposed lease tracts. Knowledge of near-surface structural conditions is fundamental to a sound lease management program for the OCS.

Geophysical data which show the shallow structural and sedimentary environment are used to predict, thereby minimizing any geologic hazards to drilling operations and consequent possible dangers to the environment from pollution. When surface and shallow subsurface geologic hazards are properly identified and correlated with surrounding strata, they seldom create insurmountable obstacles for a minimal risk program of exploration and exploitation involving economically attractive structures.

High-resolution geophysical data covering all tracts to be offered for this proposed sale will be purchased by GS and analyzed by GS geophysical personnel. These data provide definitive information on the thickness of unconsolidated sediments; structural configurations of shallow seismic horizons; sea floor anomalies, mud mounds, mud waves and potential slide areas; pipelines and other objects on the sea floor; and suitable locations for bore holes as interpreted from a combined analysis of several geophysical measurements and bathymetry.

Information from these high resolution data are extremely useful in detecting shallow geologic hazards such as potentially unstable bottom conditions (mud waves, etc.), shallow faults, and in some cases, near surface solution cavities. When these features are identified prior to drilling operations or platform construction, the operator is notified so that he can take the necessary action which will further insure that operations will be conducted with maximum safety.

Interpretations of high resolution sub-bottom profile data which disclose bottom and subsurface conditions posing a special environmental hazard for drilling or production operations in the offshore area will be made available to the Bureau of Land Management prior to the decision to issue a lease, and to the Geological Survey prior to the approval of drilling operations. If it becomes necessary, the District Supervisor, Geological Survey, will prohibit the placement of platforms on areas of instability through his authority to issue or not issue permits for platform placement.

A departure (waiver) from OCS orders or other rules of the GS Supervisor may be granted when such a departure is determined to be necessary for (30 CFR 250.12(b)) the proper control of a well, conservation of natural resources, protection of aquatic life, protection of human health and safety, and protection of property and the environment.

5. Conservation Practices

In the interest of conservation, the GS Oil and Gas Supervisor is authorized, pursuant to 30 CFR Part 250 and OCS Operating Orders, to approve well locations and well spacing programs necessary for proper development, to give consideration to such factors as the location of drilling platforms, the geological and reservoir characteristics of the field and the number of wells that can be drilled economically, the protection of correlative rights and the minimizing of unreasonable interference with other uses of the Outer Continental Shelf. The Supervisor draws his authority from the following regulations and and OCS operation orders: *30 CFR 250.11* outlines in broad terms the GS Supervisor's authority to control development of the OCS to protect the natural resources of the OCS, and to obtain maximum economic recovery of mineral resources under sound conservation practices. *30 CFR 250.16* authorizes the GS Supervisor to specify the permissible production of a well. Thereafter, OCS Order No. 11 establishes the production rate control as the Maximum Efficient Rate (MER) of the well or reservoir. *30 CFR 250.17* deals with well spacing, authorizes approval of well locations, and platform locations and lists factors for consideration in this regard. *30 CFR 250.30* requires lessee's compliance with OCS Orders and general regulations, and demands all necessary precautions to prevent damage to the environment, waste and injuries. *30 CFR 250.34* requires that lessee submit to GS Oil and Gas Supervisor exploratory drilling plans, lease development plans and applications for permits to drill prior to these programs.

The GS Oil and Gas Supervisor utilizes well information such as electric well logs, core information from other wells previously drilled in the vicinity of the proposed drilling program, geological and geophysical data and other pertinent reservoir information in order to determine the proper number of wells which are necessary for development.

At least 30 days prior to the submission of a development plan to the Supervisor, the lessee shall deliver to the Governor of each directly affected state information about the development to be proposed. Information, which is not a part of the development plan itself, shall include a description of all offshore and onshore facilities and operations proposed by the lessee or directly related to the proposed development including location, size, requirements for land, labor, materials and energy, and timing of development and operation, and other related information as may be required by the Supervisor. Any state not wishing to have such information may so indicate to the Supervisor.

Prior to the approval of a lessee's development plan, that plan, with the exception of any proprietory information, shall be provided by the Supervisor to the Governor of any directly affected state. A period of 60 days shall be provided for the Governor's review and comment upon the plan. Any state not wishing to review a development plan may so indicate to the Supervisor. (The full text of this regulation as revised November 4, 1975 can be found in Appendix 12, Final EIS for OCS Sale No. 40, Offshore the Mid-Atlantic States.) *350 CFR 250.50* grants the Director of the USGS authority to demand pooling or unitization which the Secretary is authorized to require under the OCS Lands Act in the interest of conservation. *350 CFR 250.51* refers to the unit plan regulations contained in 30 CFR 226 with regard to obtaining approval of units or cooperative agreements. *30 CFR 250.52* lists purposes for which the GS Supervisor may approve pooling or drilling agreements.

6. Other Requirements

In addition to the Interior Department's requirements, the operator must comply with applicable navigation and inspection laws and regulations administered by the U.S. Coast Guard. These relate to the safety of personnel and display of prescribed navigational lights and signals for the safety of navigation. Permits to install islands and fixed structures and permits for the drilling of wells from mobile drilling vessels must also be obtained from the U.S. Army Corps of Engineers, which is authorized by the OCS Lands Act to prevent obstruction to navigation. The decision as to whether a permit will be issued by the Corps of Engineers is based on an evaluation of the impact of the proposed work on navigation and consideration of national security. Pipeline construction must also be in compliance with standards established by the Office of Pipeline Safety Operations in the Materials Transportation Bureau, Department of Transportation. The Department of Labor establishes Occupational Safety and Health Standards which are applicable to OCS operations.

Operators must comply with the requirements of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500; 86 Stat. 816) which establishes a National Pollutant Discharge Elimination System 40 CFR Part 125, F.R. 13528 (1973). This system applies to discharge on the

OCS from any point source and requires any person to obtain a permit from the EPA for the discharge of any pollutant as defined by the Act. Discharges of any pollutant without the necessary permit from EPA is made unlawful by the Act. Pursuant to section 501(b) of the Act, the Department of the Interior has suggested to EPA that the feasibility of a memorandum of understanding between the two agencies be considered in order to facilitate the administration of the NPDES as it applies to discharges arising from OCS lease operations and to minimize any redundancy of efforts by the Geological Survey and EPA. This feasibility study is currently under consideration.

The U.S. Geological Survey also establishes GS Safety Requirements pertaining to OCS operations:

Geological Survey Standard, Outer Continental Shelf No. 1 (GSS-OCS-1) defining the safety requirements for drilling operations in a hydrogen sulfide environment was published in the Federal Register, Vol. 41, No. 42, March 2, 1976. This standard will be referenced in the Hydrogen Sulfide Section of OCS Order No. 2.

Section V

Unavoidable Adverse Environmental Effects

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As described throughout this impact statement, certain features of oil and gas operations cause adverse effects which must be considered unavoidable. However, in view of the technological state of the art, the OCS orders, regulations, and stipulations to be applied to leases resulting from this proposed sale, and the non-incremental nature of operations resulting from the sale, these unavoidable impacts from normal operations are considered to be very localized and short term in nature. Oil spills, however, are a much more serious concern, but even their long term serious impacts will occur only if a large amount of oil reaches the shoreline or shallow water. Predicting winds and currents at the time and place of a large spill (or even predicting the spill itself) is impossible. In the sections below, however, we attempt to analyze briefly not only the short term unavoidable impacts of normal operations, but also the longer term, more wide spread impacts of an oil spill on the OCS.

A. Marine Organisms

As has been discussed above in Section III.B., routine oil and gas operations that will result should this proposed sale be approved will impact marine organisms only in the immediate location of platforms, wells and pipelines. These impacts are considered temporary and minor, especially in view of the vast areas that will not be affected. Stipulations, OCS Operating Orders, and U.S. Coast Guard regulations all serve to minimize these unavoidable impacts. To recapitulate, these impacts are:

1. A minor decrease in primary productivity (i.e., phytoplankton) will occur due to turbidity caused by the disposal of drill muds and cuttings and the bottom sediments stirred up during pipeline laying and burying operations. In the vicinity of reefs and topographic features near the shelf break, this impact will be mitigated by the shunting of the muds and cuttings to within about 10 m of the bottom, reducing the turbidity plume. In any event, turbidity will only be present during the drilling, laying, and burying operations, and will affect only a very small portion of the Gulf of Mexico.

2. The drill muds and cuttings, and the sediments displaced during pipeline burial, eventually settle on the sea floor and in doing so may smother benthic organisms such as crabs, oysters, clams, etc., if the settling is heavy enough. Again, the area affected will be quite small and the impact temporary. In the case of muds and cuttings, the extent of the area affected may be reduced by shunting. In any event, there will be some burial, but experience has shown that the area will be rapidly recolonized.

3. In both 1 and 2 above, the possibility exists that toxic materials used in the mud mixtures (such as bacteriocides) may adversely affect some organisms. However, during long and extensive oil and gas operations in the Gulf of Mexico no ill effects due to such toxicity have been noted, and several studies have failed to document any toxic effect, probably because concentrations used are very low and the muds are rapidly dispersed and diluted in the sea water. Study of this aspect is continuing, however.

It is thus concluded that adverse impacts due to normal and routine operations will be minimal, insignificant, and temporary. The adverse impact that should be the most cause of concern is that of a major oil spill that reaches the shore or water shallow enough to allow the oil to reach the bottom. Such a spill is certainly not considerd routine or normal, but it must be considered. OCS Operating Orders and routine industry procedures and safety precautions should work to minimize the likelihood of such a spill and then operate to prevent a spill, should one occur, from reaching shallow water, but it can be predicted statistically that some oil will reach such waters sometime during the operations proposed by this action. It should be noted, however, that such predictions do not consider either clean-up and containment action nor degradation of the oil during a lengthy time exposed to the sea. Taking all this into consideration, it is believed that due to the distance from shore of the wells that there will be little if any adverse impact to shallow waters or the shoreline due to any oil spill in the lease areas.

Finally, there is the possibility of any oil spill from a pipeline or tanker close enough to these sensitive areas to cause a major adverse impact. Strict adherence to operating procedures and safety precautions must be ensured. Rapid response to any spills by cleanup and containment teams must be ensured. Regardless of such adherence, however, there will be some oil contamination of the environment due to chronic low level discharge ("leakage") if not to a major spill. While every effort must be made to minimize the damage due to such contamination, some damage should be expected if this lease sale is held, and must be considered part of the cost of developing oil and gas on the OCS.

B. Wetlands and Beaches

No new pipelines are anticipated to come ashore as a result of this proposed sale. However, should any occur, the unavoidable short-term impacts associated with trenching and backfilling for pipeline construction include the uprooting of all plants and non-motile animals in the path of the pipeline, thereby leaving a barren strip 9 to 12 meters wide. Some slight damage may also be rendered to vegetation in adjacent areas by machinery used in the operation. The long-term impacts may include salt-water intrusion, changes in floral and faunal components and a possible increase in marsh erosion if the canal is not backfilled.

In the event of an onshore oil pipeline leak or spillage at onshore facilities, it is inevitable that the vegetation would be affected to an extent that would be dependent upon the severity of the spill. While a small leak may do little damage, a severe leak may contaminate the substrate and kill the vegetation that comes into direct contact with the oil and several years may be required for recovery. Small animals in contact with the oil would probably be killed.

A considerable number of beaches and barrier islands are located throughout the area encompassed by this proposed sale. There are no tracts offered in this proposed sale that pose a threat to recreational beaches. However, if any of these beaches are contaminated by oil, an undetermined amount of fish and wildlife habitat (primarily birds) will be damaged. Although large numbers of birds deaths from oil spills have not been documented in the Gulf of Mexico, it is highly possible that a large number of deaths would occur should a large spill reach shore.

C. Deterioration of Air Quality

The air quality near offshore production sites will be affected should this proposed sale proceed. Although various types of emissions will be unavoidable, they are not expected to significantly contribute to reaching minimum air quality standards. In most cases, these emissions will be local in nature and be quickly dissipated by climatic conditions. There would not be an increase in air quality degradation onshore. The oil and gas that would be processed onshore would not be an increase but rather a replacement of oil and gas already being processed.

If a natural gas leak or blowout were to occur, degradation would be minimal. It is expected that the methane pollutants would quickly volatilize and drift away. In the case of a fire, pollutants would be largely carbon dioxide and water vapor. Oil leaks and oil spills which would not be accompanied by a fire would introduce highly volatile, low molecular weight hydrocarbons such as benzene and toluene into the atmosphere. These lighter fractions of crude oil would undergo some unknown degree of degradation, possibly resulting in photochemical smog. If a spill were to result in a fire, large amounts of particulate carbon and oxides of carbon, along with smaller but unknown amounts of sulfur oxides, evaporate crude oil liquids and partially oxidized compounds would enter the air. Local air quality would be severely degraded during the duration of the fire. The extent of degradation cannot be determined but it is unlikely that it would be high enough to effect land resources or human health. Should a fire occur, the resultant impact would be considered adverse and unavoidable.

D. Deterioration of Water Quality

Water quality will be temporarily degraded by resuspension of sediment during pipeline construction and burial. The jetting away of the substrate from beneath the pipeline will result in suspension of sediments which may contain pollutants such as heavy metals and pesticides. The area affected will be in the direction of the current movement. Various other phases of offshore operations (emplacement of re-entry collars, blowout preventers, drilling platforms, etc.) will also cause suspension of bottom sediments in a localized area. The magnitude of deterioration depends on numerous variables, among them bottom type, currents and duration of the activity.

During drilling operations, discharged drill cuttings will adversely affect water quality. The severity of this impact depends upon such factors as the volume and type of mud discharged and the volume and type of cuttings discharged. The turbidity plume that would result from the discharge of drilling fluids and cuttings would be localized. The expected maximum plume would be approximately 20 m wide by 800 m long.

The production and discharge of formation waters (oil field brines) may contribute to water quality degradation when released into the Gulf. Produced formation waters may contain toxic substances, heavy metals, dissolved hydrocarbons and inorganic salts. The heavy metals may include cadmium, chromium, copper, lead, mercury, nickel and zinc, although these are generally present in trace quantities (EPA, 1974). The constituents of these brines may vary from formation to formation within a single formation.

Water quality will also be somewhat affected by chronic pollutants and occasionally by a more significant oil spill.

E. Interference with Commercial Fishing Operations

As described in earlier sections, trawling operations suffer interference and inconvenience from oil and gas operations in several ways. A small area of the sea floor, up to 0.02% (approximately 0.4 hectares) of each tract leased, is occupied by drilling rigs and platforms and is unavailable to trawl fishermen. Based on past exploration success rates, up to 160 hectares of sea floor (less than one percent of the total acreage offered) may be occupied by platforms resulting from this proposed sale. Trawl nets reportedly become snagged on underwater stubs, causing damage or loss of the nets. Less frequently, large objects which were lost overboard from petroleum industry boats and platforms are caught in trawling nets, resulting in damage to the net and/or its catch of fish; however, frequency of occurrence of this type of incident is low.

Commercial fishermen would probably not trawl in the area of an oil spill, as spilled oil could coat or contaminate commercial fish species, rendering them unmarketable. This would be another adverse effect to commercial fishing.

F. Interference with Ship Navigation

Very little navigational interference can be expected between ships utilizing established fairways. However, at night, and especially during rough water, fog and heavy seas, ships which are not navigating the fairways could collide with fixed structures resulting from this proposed sale. Also, fishing boats engaged in trawling will be inconvenienced by having to navigate around fixed structures located on fishing grounds. Based on U.S. Geological Survey estimates, 20-35 new platforms could result from this proposed sale; although the increment is small in comparison to the more than 2,000 structures existing in the Gulf of Mexico, it still represents a potential increase in possible interference with ship navigation.

G. Damage to Historical and Archaeological Sites, Structures, and Objects

Prior to the laying of a proposed pipeline or the drilling of an offshore well, geophysical surveys will be conducted in those areas considered to have a potential for containing cultural resources. These survey records will be analyzed by a marine archaeologist so that loss or damage of cultural resources may be avoided. Two possibilities for damage to underwater cultural resources will still remain. The first would arise if a cultural resource, for example, an early shipwreck, is encountered in an area of the shelf where expectation of its occurrence is too low to have required a pre-development underwater survey. The chance of this occurring is very low because, at the present time, all tracts leased to a depth of approximately 50 meters will require cultural resource surveys. A study is also underway which will allow for future delineation of high and low probability areas for the offshore occurrence of cultural resources. The second possibility would arise if geophysical instruments failed to record, or if analysis of the survey records failed to interpret a cultural resource in the area surveyed. No estimate of the probability of such an occurrence can be made at this time; however, underwater cultural surveying is a new field and the quality of instrumentation and experience of personnel is steadily improving. The probability of the destruction of cultural resources as a result of the above circumstances should be small and will diminish in the future.

Other damage to archaeological resources may result from oil contamination. Historical and archaeological materials which are soiled by an accidental oil spill may not survive subsequent cleaning and restoration efforts. Porous materials contaminated with oil would be difficult if not impossible to date by using carbon dating techniques and a significant loss of scientific knowledge may result. Although the possibility of contamination of cultural resource materials by oil spills exists, this potential is very small. Even if an oil spill occurs, it is uncertain if artifacts lying on the bottom or beneath bottom sediments would be measurably affected by an oil slick covering the water above.

H. Interference with Recreational Activities

Interference with recreation is closely related to degradation of aesthetic values. Oil-contaminated beaches, freshly cut pipeline route terminals and other support facilities would normally be avoided by those seeking sites for recreational activities or for recreational development. Disturbance of beaches by pipeline burial operations will be short-lived, relative to recreational use. Oiled beaches may require days, weeks or years for adequate restorations if they become damaged. The uncertainty of accidental spills is applicable to this event also, but if spilled oil ever reached the beach, it would have an adverse effect on recreational opportunities.

The matrix analysis lists a number of tracts which, because of their proximity to known resources and activities, may result in damage if 1,000 bbls. or more of oil were spilled and drifted toward that resource or activity area. The number of such tracts which could have a maximal impaction recreational values is listed below by type of value.

Commercial and sport fishing, 49 tracts
Outdoor recreation, 15 tracts
Cultural resources, 15 tracts

I. Degradation of Aesthetic Values

Platforms and drilling rigs may be located in 50 tracts, included in this proposal lying from 5-27 km offshore. Some of these may be visible from shore. No new pipeline terminals or treatment facilities are expected to be constructed as a result of this proposed sale.

If structure location were to interfere with residential or recreational vistas, the visual effect would probably be considered adverse. However, the incremental addition to what already exists in the region would be small, therefore potential impact is considered minimal.

Spilled oil and debris which would float in the water or wash up on the beach would also severely detract from the scenic values of any local area. Before the natural terrain and vegetation has been completely restored, the effects of pipeline burial will appear as a large scar traversing the beach and coastal lands. Restoration over most of the scarred area will require at least one year. If a pipeline enters a forested shore, the corridor would be visible for several years thereafter. Since no new lines are expected to go ashore, these impacts are considered insignificant.

J. Conflict with Other Uses of Land

It is anticipated that excess capacity in the existing gas and oil related infrastructure in the coastal zones of the adjacent states are expected to absorb most of the sale related land use requirements. A total of 0-32 hectares (required for 0-2 terminal storage facilities) was identified as the only incremental land use demand induced by the proposed sale. This acreage is very small, and there are undoubtedly alternative sites available in the general areas identified which could host such facilities. If properly sited in accordance with a comprehensive land use plan, these facilities should present no conflict with other land uses.

K. Summary

In summary, all unavoidable adverse impacts that will be sustained by the natural environment as a result of routine operations will be relatively localized in their effects. Many will be followed by unhindered natural recovery within relatively short time periods. A massive accidental oil spill could result in severe and widespread damage of major consequence. Therefore, all the tracts identified for oil and gas production in this proposed sale do contain varying degrees and types of adverse impact potentials. Only a massive oil spill accident would result in significant adverse impacts; however, the probability that such a massive spill will occur is relatively low.

Section VI

Relationship Between Local Short-Term Use and Maintenance and Enhancement of Long-Term Productivity

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As indicated in Section III, the operations resulting from this proposed lease sale, if it is held, will have a small, localized, and short term effect on some of the living resources of the Gulf of Mexico Outer Continental Shelf. Some plants and animals will be killed, and some areas will be eliminated as habitat. On the other hand, platforms constructed in the Gulf will provide some new habitat. In any event, the long term effects on the biota of OCS oil and gas operations are considered to be very small: if all such operations were to cease tomorrow, and all platforms and unburied pipelines removed, within a few years the biological communities would probably return to pre-drilling levels and compositions, barring other natural and man-made disturbances. Even an oil spill would probably have only short-term effects on the biota (i.e., several years if contained and cleaned up properly) despite its visibility and seemingly disastrous nature at the time of the spill.

The induced development may result in short-term adverse impacts to communities. A strain on existing infrastructure would be expected if new OCS-related facilities are located in areas of low population with little current industrial base. However, in the long-term, an adjustment can be expected as population gains and induced industrial development are absorbed in the expanded communities. Land utilized for facilities directly associated with OCS operations will be excluded from other uses over the 25-year life of the field; however, only a portion of this land area may continue to be so utilized after production ceases.

The major tradeoff, then, between short-term use and long-term productivity involves the mineral resources, specifically oil and gas, and the effects of such minerals on economic conditions such as employment, production of other products, use for heat and light, and use in transportation. Over the short-term, oil and gas is needed for these uses. But if it isn't produced on the OCS of the United States, it will probably be imported. Such importation will have its own effect on employment in the U.S. gas and oil industry and perhaps on the price of oil and gas. Also, producing U.S. OCS oil and gas now will preclude the use of that oil and gas in the future when imports may be unavailable. This is the most important long-term commitment that would result from this sale: the use now of resources that may be needed in the future.

If this sale were not to be held (or more accurately, not to be held at this time) offshore industry employment would be reduced, but other employment should remain about the same, since increased imports would probably be used to make up for decreased Gulf OCS production. In the future, when this OCS oil and gas would be produced, offshore employment would then increase.

If this sale is not held, or exploration and production activities in the Gulf of Mexico do not continue, the most probable result will be a continuation in the decline of oil and condensate production in the Gulf of Mexico. If this decline occurs, it is probable that the refining centers in the Gulf of Mexico will utilize additional crude oil from other areas. To the extent that this oil is transported by tanker to the refineries, a potential impact to the long-term productivity of other resources would be present due to the potential for oil spills attributable to marine transportation activities.

Development of OCS oil and gas must be a part of a national energy policy which considers all forms, uses, and sources of energy. It is in such a context that the decision to hold this proposed sale or not will be made by the Secretary of the Interior.

Section VII

Irreversible and Irretrievable Commitment of Resources

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A. Mineral Resources

Leasing of the proposed tracts in this sale would permit development and extraction of the minerals contained herein. This proposed lease sale could result in production of 75-150 million barrels of oil and 1.5-2.5 trillion cubic feet of gas which would represent an irreversible and irretrievable commitment of these mineral resources.

More than one mineral lease may be issued for the same area for the retrieval of other types of minerals, but CFR 43, Part 3307, 4-5 provides that other leases may not unreasonably interfere with or endanger operations of any existing lease.

Other mineral resources in the form of fuels required for exploration, production, and transportation of resources discovered and produced as a result of this sale would be irretrievably committed.

Exploration, production, and transportation of the sale related hydrocarbons would require the use of fabricated metal products. Although recovery of some portion of these products could be carried out at the end of oil and gas related activity, some of these mineral products would be irretrievably committed.

B. Land Resources

It has been estimated that 0-2 terminal storage facilities may result from this proposed sale. This would represent a long-term use of land resources, but not an irreversible and irretrievable commitment.

Since no major trunklines are anticipated to result from this sale, no permanent dedication of land resources for pipeline right-of-way purposes is anticipated. Incremental additions of pipeline right-of-way will be required on the Outer Continental Shelf in order to connect new producing facilities to existing pipelines. Areas required for this purpose, as well as the area required for platform installation would be withdrawn during the life of production, but these uses would not be irreversible and irretrievable in nature.

The continued use of existing facilities within the oil and gas related economies of the states bordering the Gulf of Mexico implies that to some extent land resources may be committed to longer periods than would otherwise be anticipated, but probably not in an irreversible and irretrievable manner.

Some facilities, such as refineries, are not completely dependent on OCS production for their continued operation, although continued OCS production could be conceived as one factor that may have some marginal effect in inducing the continued utilization of an existing facility.

The states bordering the Gulf of Mexico contain the home areas of persons engaged in the exploration, production, and transportation of oil and gas produced from the OCS, as well as production from areas located onshore and in state marine waters. To the extent that these persons are employed in activities related to the Outer Continental Shelf, their continued employment would imply the continued use of existing dwellings and land areas required for residential uses, as well as land areas required for commercial and other uses which meet the needs of these residents for goods and services.

C. Fish and Wildlife Resources

An irreversible or irretrievable commitment of fish and wildlife resources and their habitats could occur in the area of a massive oil spill or in an area frequently subjected to chronic low-level oil pollution. However, it is anticipated that once an area recovered from a spill that the natural fauna (excluding an endemic endangered species population) would reoccupy a vacated habitat.

In the event that an oil spill of sufficient magnitude, or some other adverse impact related to OCS operations, resulted in severe losses to the population of an endemic endangered species, it is possible that an irreversible and irretrievable commitment to the extinction of this species would have been made in the area impacted.

D. Cultural Resources

Any damage to archaeological sites will comprise an irretrievable commitment of non-renewable resources. To the extent that the archaeological sites could be avoided by careful location of OCS facilities, no irretrievable commitment of these resources would result from activities related to this sale. It is believed that the stipulations to this sale (see Section IV.D.) combined with the OCS Orders and regulations of the USGS and the coordination that takes place between BLM, USGS, and the National Park Service (NPS), will serve to ensure that drilling, structures, and pipelines are located well clear of archaeological sites.

E. Human Resources

Since 1954, when Outer Continental Shelf leasing began, through February 1976, there have been 75 deaths directly associated with drilling operations in the Gulf of Mexico. In addition, there have been numerous deaths associated with oil and gas production on the OCS including helicopter crashes and boat accidents. It will be impossible to avoid all human casualties, but they have been minimized through measures already implemented which are continually updated to improve the safety of OCS operations. Fatalities and/or permanent impairment as a consequence of accidents and personnel error will result in an irreversible and irretrievable commitment of human resources.

During the period when sale related activities were being carried forward, skilled personnel would be employed in many activities such as exploration, production, and transportation. To the extent that their efforts were devoted to sale related activities during a period of time, their services could not be employed in alternative areas. Therefore, an irreversible and irretrievable commitment of skill, knowledge, and labor will result from this sale.

F. Economic Resources

A decision to proceed with this proposed sale would result in production of certain OCS-related goods and services, including investments in required facilities, stimulation of certain industries within the region, and if recoverable resources are proved, oil and gas. To the extent that resources would be drawn away from other uses, production of goods and services in other areas or of other types would possibly have to be foregone. Steel products, specialized manpower and capital constitute required resources which may be the scarcest, and use of these resources to develop this proposal would mean that other opportunities for their use might have to be foregone. While these resources may be reclaimed over time, their use as a result of this proposed sale would constitute an irreversible and irretrievable commitment of resources during a period of time.

To the extent that unemployed resources are used, the employment of resources as a result of this proposed sale would not constitute a cost to society in the form of foregone opportunities.

Section VIII

Alternatives to the Proposed Action

U.S. DEPARTMENT OF THE INTERIOR
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The proposed action being considered is OCS Sale No. 45 and the alternatives to holding the sale are considered to be 1) hold the sale in modified form, 2) withdraw the sale, and 3) delay the proposed sale. Figure I-1 portrays the 120 tracts tentatively selected for this proposed sale.

A. Hold the Sale in Modified Form

An analysis of each tract proposed to be offered in this sale has been made in an attempt to quantify the environmental risks encountered by oil and gas development of these areas. This analysis is shown in Appendix D. The resource factors considered include littoral systems, reefal systems, other benthic systems, endangered species, commercial and sport fishing, shipping, aesthetics, outdoor recreation and cultural resources. The impact producing factors are considered to be the potential occurrence of oil spills and the presence of structures required for production activities on the lease tracts.

Based on consideration of the resource factors and the impact producing factors, each tract was assigned a sensitivity value indicating the sensitivity of each tract to each impact producing factor. The three levels of potential magnitude of impact are: 3, Maximal potential impact; 2, Moderate potential impact; and 1, Minimal potential impact.

Fifteen tracts (85, 86, 87, 88, 101, 102, 104, 108, 109, 110, 111, 112, 113, 115, 116) pose a maximal potential impact on littoral systems in adjacent areas. Elimination of the environmental risk to littoral systems would prevent potential damage to ecosystems in nearshore and onshore areas due to oil spills from wells drilled on these tracts or from equipment and vessels working on these tracts. The principal resources at risk are the marshlands of Texas and Louisiana.

Only two tracts (50, 55) are believed to pose a maximal potential impact on reefal systems. Deletion of these tracts would prevent potential damage to unique biotic assemblages. It should be noted, however, that if the stipulations proposed for these two tracts (see Section IV.D.) are applied to leases on them, it is believed by BLM that no significant damage to the reefs will occur as a result of oil and gas operations.

Forty-nine tracts (12, 18, 22-27, 36-45, 59-63, 66, 68, 73, 74, 79, 80, 85-89, 95-99, 101-105, 108-111, 116) are believed to pose a maximal potential impact on sport and commercial fishing. Elimination of these tracts would remove the potential for impairment of these areas for recreational or commercial fishing purposes.

Thirty-four tracts (1, 2, 4, 5, 11, 22, 25, 26, 34-38, 40-43, 54, 57, 61, 62, 65, 66, 69-71, 87, 88, 101, 104, 111, 113, 114, 116) pose a maximal potential impact on shipping. Elimination of these tracts would eliminate much of the potential for collision between fixed structures and marine traffic resulting from this proposed sale.

Eleven tracts included in the proposed sale are estimated to present a risk of maximal potential impact on other resources and activities on the OCS. The additive impact of these tracts range from 1.44 to 2.00 and is interpreted to mean that the risk of damage to all other identified resources and activities from the placement of structures or the occurrence of oil spills is the greatest for these tracts.

One alternative would be to delete these tracts (85, 86, 87, 88, 101, 104, 108, 109, 110, 111 and 116). Although the adoption of this alternative would not necessarily eliminate all of the tracts posing a risk of maximal impact to a particular resource, it is believed that the adoption of this alternative would eliminate some degree of risk to all of the other identified resources.

IMPACTS:

Acceptance of the alternative to delete all tracts identified as having a maximal additive potential impact would have an environmental effect of reducing the total number of platforms. It would also incrementally reduce the discharges and disposal of waste water, drill cuttings and muds that are estimated to occur along with exploration, development and production. It is not possible at this time to determine what effects the deletion of these tracts would have on the estimated miles and number of additional offshore pipelines that might be required for this proposed sale, but acceptance of this alternative would probably have little effect on major lines to shore. However, it is possible that deletion of these tracts would eliminate a few of the small flow lines that connect platforms with other platforms and eventually with major pipelines to shore.

The deletion of these tracts would result in the elimination of 15,456 hectares (38,193 acres), approximately 7% of the total area proposed for this sale. The tracts affected are oil/gas tracts. Therefore, the deletion of these tracts could result in a reduction by some 7% of oil and gas production which could result from this sale. This deletion could also reduce the number of wells drilled by 10 to 28 from the number of wells estimated by the USGS (150-400 wells). The reduction in the number of platforms can be only roughly estimated. In the event that all of the tracts were productive and fully developed, the reduction in platforms could amount to 22. Such a reduction would reduce the potential risk to littoral systems, reefal systems, sport and commercial fishing and shipping.

B. Withdraw the Sale

Another option is to cancel the proposed sale. This alternative would reduce the future OCS oil and gas production and would thus necessitate other measures such as increased imports, reduced energy consumption by reducing demand or supply shortfalls, or the development of alternative energy sources, or a combination of the above measures.

Alternative energy measures to offshore oil and gas include:

- Energy conservation
- Conventional oil and gas supplies
- Coal
- Nuclear
- Oil shale
- Hydroelectric power
- Solar energy
- Energy imports
  - Oil imports
  - Natural gas imports
  - Liquefied natural gas imports
- Geothermal energy
- Other energy sources (wind, tidal)

Table VIII-1 estimates the energy required from other sources to replace the expected petroleum production from proposed Sale 45.

A discussion of energy alternatives can be found in "*Energy Alternatives: A Comparative Analysis*" by the Science and Public Policy Program of the University of Oklahoma. Copies of this study are available for review in the New Orleans OCS Office, and can be purchased for $7.45 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock Number 041-011-00015-4). Further discussion of some of these alternatives and their impacts can be found in "*Final Environmental Impact Statement*, Volumes 1-3, Proposed Increase in Oil and Gas Leasing on the Outer Continental Shelf" by the U.S. Department of Interior, 1975.

Impacts:

None of the environmental effects expected from the proposed sale would occur should the proposed sale be withdrawn. Another major impact would be a further delay in the national goal of achieving energy independence. The estimated 75 to 150 million barrels of oil and the 1.5 to 2.5 trillion cubic feet of gas which would result from this sale would have to be supplied from other sources; the majority of it imported. Increased imports could have adverse economic impacts. The current natural gas shortages in the U.S. are projected to cause actual curtailments of 3.6 trillion cubic feet of gas for the year ending March 31, 1977. The total estimated gas reserves which could eventually be made available through this proposed major lease sale would not offset even these currently projected interstate gas curtailments. Severe industrial gas shortages on a national level could continue to cause plant shutdowns or reductions in economic output.

The extensive petroleum refining industry in the Gulf of Mexico is an important component of the total national industry. In the event that oil production does not result from this proposed sale, due to withdrawal of the sale, it appears likely that crude oil imports will be utilized in place of this volume of domestic oil production. Since this foreign crude oil would be transported in tankers, oil spills originating from tanker operations could result. Furthermore, this increased tanker traffic could increase the possibility of collision of tankers with other shipping and existing fixed-structures, resulting in spilled oil, injuries and deaths.

The energy expected to be realized from this proposed sale could be provided from coal. The acceleration of coal development to the point of replacing expected energy resources from the proposed OCS sale within a similar timeframe, however, would probably have a greater adverse impact on the general environment than the proposed action. Such impact would affect other sections of the U.S. and have environmental consequences of a different nature (land disruption, air pollution).

The substitution of energy resulting from the proposed sale by other sources such as oil shale, hydroelectric power, geothermal energy, solar

Table VIII-1 Energy Needed from Other Sources to Replace the Expected Oil and Gas Production from the Proposed OCS Sale No. 45

	Billion Btu/day
1. Btu equivalents:[1]	
Oil - 15,000-30,000 bbl/day	56-140
Gas - 300,000-500,000 thous.cu.ft./day	306-511
Total	362-651
2. Oil equivalents:	Bbl/day
Oil from other sources needed to directly replace expected oil production	10,000-25,000
Oil from other sources needed to replace expected gas production	54,643-91,250
Total	64,643-116,250
3. Gas equivalents:	MMcf/d
Gas from other sources needed to replace expected oil production	55-137
Gas from other sources needed to directly replace expected gas production	300-500
Total	382-665
4. Coal equivalent:	Thousand short tons/day
	15.1-27.1
5. Electrical equivalents:	Thousands of megawatts of capacity
Substitutes for end uses[2]	2,299-4,134
Substitute as input to electricity generation[3]	1,768-3,180

1 Conversion factors used:
1 barrel of oil = 5.6×10^6 Btu.
1 cubic foot of natural gas = 1,021 Btu.
1 ton of coal = 24×10^6 Btu.
1 kilowatt hour = 3,412 Btu at the theoretical conversion rate of other energy forms to electricity at 100 percent efficiency.

2 Based on a 65 percent average efficiency of end use of oil and gas (such as oil and gas heating) and a plant load factor of 80 percent

3 Efficiency of fossil fuel electricity generation was assumed to be 40 percent. Efficiency of present fossil fuel generation averages about 33 percent.

energy and other energy sources is beyond our technological capabilities at the present time. Much research is being done in these fields and in the future, greater dependence on them may be feasible.

In summary, the major environmental effects of the proposal would be entirely avoided. Withdrawal of this sale would, however, further intensify the problem of importation by tanker which would further increase the chance of collision and tanker accident in the Gulf of Mexico region with greater potential environmental effects as well as have an adverse economic impact.

C. Delay the Sale

The sale could be delayed for a period of time sufficient to develop new environmental protection equipment, the completion of studies in the Gulf of Mexico concerning potential environmental impacts of offshore mineral development, the development of coastal zone plans, or the development of other legislation.

In the event that this option is selected, all of the environmental effects that are discussed in this impact statement would be postponed during the delay time.

Impacts:

Requirements of refineries in the Gulf of Mexico for crude oil would probably be met by a minor increase in imported crude oil. During October, 1976, imports of foreign crude oil into the U.S. amounted to approximately 5.7 million barrels per day, and the sale related production amounts to less than one half of one percent of this level of imports. The delay in natural gas production would probably cause increased volumes of natural gas to be imported. The volume of natural gas anticipated to result from this proposed sale would be sufficient to provide a daily volume of natural gas approximately equal to 5% of the curtailments in interstate natural gas deliveries during the 1976-77 heating season. A delay in holding the sale might cause losses of employment in the offshore activity related to exploration, production, and transportation of crude oil and natural gas, but the availability of imports should permit the processing, manufacture, and transportation of petroleum products derived from imported crude to continue. Unemployment effects due to shortages of natural gas are more difficult to determine, but would more likely have their major effect at points further from the Gulf of Mexico.

Section IX

Consultation and Coordination with Others

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BLM
NEW ORLEANS OCS

A. Preparation of the Draft Environmental Statement

This Draft Environmental Impact Statement, following so closely the DEIS for Sale 47 (which was made available on November 12, 1976), is essentially an update of that DEIS, and comments and recommendations received with regard to the DEIS for Sale 47 have been incorporated, when appropriate, into this statement.

1. Federal Agencies

The Bureau of Land Management consults with numerous Federal agencies in the ongoing process of assessing the environmental, social, and economic implications for the Gulf of Mexico energy development program.

These agencies include:

Department of Agriculture

Forest Service
Soil Conservation Service
Agricultural Conservation and Stabilization Service
Extension Service

Department of Commerce

National Weather Bureau
Bureau of the Census
Social and Economic Statistics Administration
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Coastal Zone Management
Office of Ecology and Environmental Conservation

Department of Defense

Deputy Assistant Secretary
Eastern Sea Frontier Commander
United States Air Force
United States Navy
Naval Oceanographic Office
United States Army
Corps of Engineers

Department of the Interior

Bureau of Mines
Bureau of Outdoor Recreation
U.S. Fish and Wildlife Service
U.S. Geological Survey
National Park Service

Department of Transportation

Federal Aviation Administration
Federal Highway Administration
U.S. Coast Guard

Department of the Treasury

Energy Research and Development Administration

Environmental Protection Agency

Federal Energy Administration

Federal Power Commission

2. State and Local Agencies

BLM also works closely with the Gulf states; their expertise is invaluable in developing statements and policies, and BLM endeavors to keep the states informed of BLM's plans and policies. Texas and Louisiana state agencies with which BLM has consulted include:

Texas

Governor's Budget and Planning Office
Texas Parks and Wildlife Department
Texas Coastal and Marine Council
Texas State Historic Preservation Officer
General Land Office
Texas Railroad Commission
Texas Water Rights Commission
Texas Water Development Board
Texas Industrial Commission
Governor's Energy Advisory Council
Texas Water Quality Board
Bureau of Economic Geology—University of Texas

Louisiana

State Mineral Board
Commission on Intergovernmental Relations
Louisiana Wildlife and Fisheries Commission
Louisiana Stream Control Commission
Louisiana State Parks and Recreation Commission
Louisiana Coastal Commission
Louisiana Geological Survey
Louisiana Department of Conservation
Louisiana Health and Human Resources Administration
Louisiana Office of State Planning
Louisiana Forestry Commission
Department of Public Works—Atchafalaya Basin Division
Louisiana State Historic Preservation Officer

B. Coordination and Review of the Draft Environmental Statement Leading to

Preparation of the Final Environmental Statement

1. Public Hearing

A public hearing will be held in New Orleans, Louisiana, probably in June 1977. The purpose of this hearing is to receive views, comments, and suggestions relative to this environmental impact statement and the proposed action as part of the OCS accelerated leasing program.

At the conclusion of each person's testimony, if desired, members of the hearing panel may question the witness to clarify or expand witness testimony.

A complete official transcript of the hearing plus written comments received will be available for public inspection at the Bureau of Land Management in the New Orleans Outer Continental Shelf Office, in New Orleans, Louisiana, and in Washington, D.C., shortly after the hearing.

In addition to comments received at the public hearing, all written comments to this Draft EIS will be carefully reviewed, both for editorial and typographical improvements and for matters of a substantive nature. Where possible and appropriate, the environmental statement will be revised to correct errors and omissions and to clarify and/or augment discussion of issues of concern. All substantive issues will be analyzed to determine revisions necessary to strengthen and improve upon the draft statement. Wherever possible, the final statement will reflect consideration given to these issues.

Section X

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BLM

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Section XI

Appendices

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BLM
NEW ORLEANS OCS

Appendix A

APPENDIX A

List of Tracts Proposed for Leasing in Sale No. 45

Tract Number	Block	Description	Res.	Hectares		Distance From Shore (Kilometers)	Water Depth (Meters)
South Padre Island Area (PS)							
1	1041	All	G	2331		27	37
2	1051	All	G	2331		26	37
North Padre Island Area (PN)							
3	956	All	G	2331		29	35
Mustang Island Area (MU)							
4	765	All	G	2331		37	37
5	776	Fed. Por.1/	G	2288	est.	18	24
6	799	Fed. Por.1/	G	2329	est.	19	26
7	815	All	G	2331		21	27
8	857	All	G	2331		24	29
9	866	All	G	2331		26	31
10	A22	All	G	2331		56	62
Mustang Island Area, East Addition (MU)							
11	A149	All	G	2331		77	101
Matagorda Island Area (MI)							
12	487	Fed. Por.1/	G	403	est.	16	18
13	634	All	G	2331		23	24
14	657	Fed. Por.1/	G	2052	est.	19	22
15	666	All	G	2331		24	26
16	679	All	G	2331		48	48
17	703	All	G	2331		40	40
Brazos Area (BA)							
18	488	Fed. Por.1/	G	1659	est.	18	18
19	A29	All	G	2331		69	48
Brazos Area, South Addition (BA)							
20	A77	All	G	2331		66	51
21	A104	All	G	2331		61	59

Tract Number	Block	Description	Res.	Hectares	Distance From Shore (Kilometers)	Water Depth (Meters)
Galveston Area (GA)						
22	212	All	G	2331	21	16
23	223	All	G	2331	21	18
24	224	All	G	2331	24	18
25	225	All	G	2331	27	16
26	256	All	G	2331	32	16
27	282	All	G	2331	21	18
28	327	All	G	2331	48	26
29	382	All	G	2331	35	27
30	391	All	G	2331	42	29
31	392	S½	G	1165	40	29
32	393	All	G	2331	37	27
33	420	All	G	2331	40	29
Galveston Area, South Addition (GA)						
34	A129	All	G	2331	106	51
35	A158	All	G	2331	109	53
High Island Area (HI)						
36	71	NE¼; W½	G	1748	27	13
37	109	All	G	2331	26	15
38	196	All	G	2331	40	16
39	199	All	G	2331	48	16
40	207	All	G	2331	37	16
41	228	All	G	2331	35	16
42	231	All	G	2331	47	16
43	235	All	G	2331	43	17
High Island Area, East Addition (HI)						
44	75	All	G	1165	32	13
45	76	All	G	1184	32	13
High Island Area, East Addition, South Extension (HI)						
46	A262	All	G	2331	135	46
47	A287	All	G	2331	145	57
48	A300	All	G	2331	143	60
49	A347	All	G	2331	180	71
50	A374	All	G	2331	190	115
51	A381	All	G	2331	170	91
52	A395	All	G	2331	193	115

Tract Number	Block	Description	Res.	Hectares	Distance From Shore (Kilometers)	Water Depth (Meters)
High Island Area, South Addition (HI)						
53	A468	All	G	2331	137	59
54	A507	All	G	2331	108	53
55	A512	All	G	2331	124	59
56	A522	All	G	2331	151	70
57	A529	All	G	2331	129	59
58	A551	All	G	2331	150	80
West Cameron Area (WC)						
59	21	E½ Fed. Por.2/	G	537 est.	8	8
60	70	All	G	2023	14	11
61	83	All	G	2023	19	12
62	137	All	G	2023	31	13
63	138	All	G	2023	29	13
64	275	All	OG	2023	93	25
65	276	All	OG	2023	92	27
West Cameron Area, West Addition (WC)						
66	359	All	OG	2023	87	18
67	374	All	OG	2023	90	21
68	376	All	OG	1827	85	20
69	385	All	OG	2023	97	27
70	428	All	OG	2023	116	33
West Cameron Area, South Addition (WC)						
71	510	All	G	2023	135	56
72	571	All	G	2023	167	60
East Cameron Area (EC)						
73	13	All	G	2023	13	11
74	14	W½NW¼; NW¼SW¼; S½S½	G	885	11	11
75	143	W½	G	1012	61	26
East Cameron Area, South Addition (EC)						
76	258	All	G	2023	121	48
77	259	All	G	2023	121	47
78	267	All	G	2023	126	53
Vermilion Area (VR)						
79	18	Fed. Por. 2/	G	977 est.	6	9
80	37	All	G	2023	13	10

Tract Number	Block	Description	Res.	Hectares	Distance From Shore (Kilometers)	Water Depth (Meters)
South Marsh Island Area (SM)						
81	20	All	OG	2023	61	22
South Marsh Island Area, South Addition (SM)						
82	105	All	OG	2023	117	56
83	106	N½	OG	1012	116	55
84	133	All	G	1012	132	62
Eugene Island Area (EI)						
85	(9	Fed. Por.2/	OG	79 est.	11	4
	(25	Fed. Por.2/	OG	1811 est.	14	5
86	11	Fed. Por.2/	OG	212 est.	11	4
87	39	All	OG	2023	11	4
88	56	All	OG	2023	14	5
89	92	All	OG	2023	43	10
90	174	All	OG	2023	64	25
Eugene Island Area, South Addition (EI)						
91	353	All	OG	2023	126	83
92	363	All	OG	2023	126	95
93	364	All	OG	2023	126	95
94	372	All	OG	2023	130	101
Ship Shoal Area (SS)						
95	61	All	OG	2023	13	6
96	62	All	OG	2023	10	6
97	110	All	OG	2023	27	16
98	118	S½	OG	1012	27	16
99	136	All	OG	2023	29	15
100	202	All	OG	2023	61	33
South Pelto Area (PL)						
101	5	All	OG	2023	10	10
102	15	All	OG	2023	16	14
103	22	All	OG	2023	21	17
South Timbalier Area (ST)						
104	11	Fed. Por.2/	OG	540 est.	6	7
105	104	All	OG	1527	40	18
Grand Isle Area (GI)						
106	83	All	OG	2023	45	47

Tract Number	Block	Description	Res.	Hectares	Distance From Shore (Kilometers)	Water Depth (Meters)
Grand Isle Area, South Addition (GI)						
107	92	All	OG	2023	61	71
West Delta Area (WD)						
108	26	Fed. Por. 2/	OG	1435 est.	8	9
109	33	N½	OG	1012	16	19
110	47	All	OG	2023	16	15
South Pass Area (SP)						
111	29	Fed. Por. 2/	OG	253 est.	8	18
112	36	Fed. Por. 2/	OG	1427 est.	10	37
113	(39	Fed. Por. 2/	OG	251 est.	5	35
	(42	Fed. Por. 2/	OG	148 est.	5	33
	(43	Fed. Por. 2/	OG	1707 est.	6	39
Main Pass Area (MP)						
114	60	All	OG	2021	19	22
115	77	Fed. Por. 2/	OG	855 est.	6	37
116	102	All	OG	2021	13	7
Viosca Knoll Area (VK) (also known as Mobile South No. 1)						
117	944(N666E70)	All	OG	2331	32	150
118	774(N670E76)	All	OG	1716	58	110
Mississippi Canyon Area (MC) (also known as Mobile South No. 2)						
119	267(N658E47)	All	OG	881	51	183
120	149(N661E61)	All	OG	2271	19	183

1/ That portion seaward of the three marine league line.

2/ That portion of the lease block which is more than 3 geographical miles seaward from the line described in the supplemental decree of the U. S. Supreme Court, June 16, 1975 (United States vs Louisiana, 422 U. S. 13).

Appendix B

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 1

Effective August 28, 1969

MARKING OF WELLS, PLATFORMS, AND FIXED STRUCTURES

This order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.37. Section 250.37 provides as follows:

Well designations. The lessee shall mark promptly each drilling platform or structure in a conspicuous place, showing his name or the name of the operator, the serial number of the lease, the identification of the wells, and shall take all necessary means and precautions to preserve these markings.

The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Identification of Platforms, Fixed Structures.* Platforms and structures, other than individual wellhead structures and small structures, shall be identified at two diagonal corners of the platform or structure by a sign with letters and figures not less than 12 inches in height with the following information: The name of lease operator, the name of the area, the block number of the area in which the platform or structure is located, and the platform or structure designation. The information shall be abbreviated as in the following example:

"The Blank Oil Company operates 'C' platform in Block 37 of South Timbalier Area."

The identifying sign on the platform would show:

"BOC - S.T. - 37 - C."

2. *Identification of Single Well Structures and Small Structures.* Single well and small structures may be identified with one sign only, with letters and figures not less than 3 inches in height. The information shall be abbreviated as in the following example:

"The Blank Oil Company operates well No. 1 which is equipped with a protective structure, in Block 68 in the East Cameron Area."

The identifying sign on the protective structure would show:

"BOC - E.C. - 68 - No. 1"

3. *Identification of Wells.* The OCS lease and well number shall be painted on, or a sign affixed to, each singly completed well. In multiple completed wells each completion shall be individually identified at the well head. All identifying signs shall be maintained in a legible condition.

/s/ Robert F. Evans
Supervisor

Approved: August 28, 1969

/s/ Russell G. Wayland
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 2
Effective January 1, 1975

DRILLING PROCEDURES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11. All exploratory and development wells drilled for oil and gas shall be drilled in accordance with 30 CFR 250.34, 250.41, 250.91, and the provisions of this Order which shall continue in effect until field drilling rules are issued. When sufficient geologic and engineering information is obtained through exploratory drilling, operators may make application or the Area Supervisor may require an application for the establishment of field drilling rules. After field drilling rules have been established by the Area Supervisor, development wells shall be drilled in accordance with such rules.

All wells drilled under the provisions of this Order shall have been included in an exploratory or development plan for the lease as required under 30 CFR 250.34. Each application for Permit to Drill (Form 9-331C) shall include all information required under 30 CFR 250.91, and shall include a notation of any proposed departures from the requirements of this Order. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b).

The operator shall comply with the following requirements. All applications for approval under the provisions of this Order shall be submitted to the appropriate District Supervisor.

1. *Well Casing and Cementing*. All wells shall be cased and cemented in accordance with the requirements of 30 CFR 250.41(a)(1), and the Application for Permit to Drill shall include the casing design safety factors for collapse, tension, and burst. In cases where cement has filled the annular space back to the Gulf floor, the cement may be washed out or displaced to a depth not exceeding 40 feet below the Gulf floor to facilitate casing removal upon well abandonment. For the purpose of this Order, the several casing strings in order of normal installation are drive or structural, conductor, surface, intermediate, and production casing.

The design criteria for all wells shall consider all pertinent factors for well control, including formation fracture gradients and pressures and casing setting depths such that the well bore could be expected to withstand a pressure equivalent to at least a 0.5-ppg kick. All casing, except drive pipe, shall be new pipe or reconditioned used pipe that has been tested to insure that it will meet API standards for new pipe.

A. *Drive or Structural Casing*. This casing shall be set by drilling, driving, or jetting to a minimum depth of 100 feet below the Gulf floor or to such greater depth required to support unconsolidated deposits and to provide hole stability for initial drilling operations. If this portion of the hole is drilled, the drilling fluid shall be of a type that is in compliance with the liquid disposal requirements of OCS Order No. 7, and a quantity of cement sufficient to fill the annular space back to the Gulf floor shall be used.

B. *Conductor and Surface Casing*. Casing design and setting depths shall be based upon all engineering and geologic factors, including the presence or absence of hydrocarbons or other potential hazards and water depths.

(1) *Conductor Casing*. This casing shall be set at a depth in accordance with paragraph 1B(3) below. A quantity of cement sufficient to fill the annular space back to the Gulf floor shall be used.

(2) *Surface Casing*. This casing shall be set at a depth in accordance with paragraph 1B(3) below and cemented in a manner necessary to protect all freshwater sands and provide well control until the next string of casing is set.

This casing shall be cemented with a quantity sufficient to fill the calculated annular space to at least 1,500 feet above the surface casing shoe and at least 100 feet inside the conductor casing or as approved by the District Supervisor. When there are indications of improper cementing, such as lost return, cement channeling, or mechanical failure of equipment, the operator shall recement or make the necessary repairs. After drilling a maximum of 100 feet below the surface casing shoe, a pressure test shall be obtained to aid in determining a formation fracture gradient either by testing to formation leak-off or by testing to a predetermined equivalent mud weight. The results of this test and any subsequent tests of the formation shall be recorded on the driller's log and used to determine the depth and maximum mud weight of the intermediate hole.

(3) *Conductor and Surface Casing Setting Depths*. These strings of casing shall be set at the depth specified below, subject to approved variation to permit the casing to be set in a competent bed, or through formations determined desirable to be isolated from the well by pipe for safer drilling operations, provided, however, that the conductor casing shall be set immediately prior to drilling into formations known to contain oil or gas, or, if unknown, upon encountering such formations. These casing strings shall be run and cemented prior to drilling below the specified setting depths. For those wells which may encounter abnormal pressure conditions, the District Supervisor may prescribe the exact setting depth. Conductor casing setting depths shall be between 500 feet and 1,000 feet (TVD below Gulf floor).

Engineering and geologic data used to substantiate the proposed setting depths of the conductor and surface casing (such as estimated fracture gradients, pore pressures, shallow hazards, etc.) shall be furnished with the Application for Permit to Drill.

C. *Intermediate Casing*. This string of casing shall be set when required by anticipated abnormal pressure, mud weight, sediment, and other well conditions. The proposed setting depth for intermediate casing will be based on the pressure tests of the exposed formation below the surface casing shoe.

A quantity of cement sufficient to cover and isolate all hydrocarbon zones and to isolate abnormal pressure intervals from normal pressure intervals shall be used. If a liner is used as an intermediate string, the cement shall be tested by a fluid entry or pressure test to determine whether a seal between the liner top and next larger string has been achieved. The test shall be recorded on the driller's log. When such liner is used as production casing, it shall be extended to the surface and cemented to avoid surface casing being used as production casing.

D. *Production Casing*. This string of casing shall be set before completing the well for production. It shall be cemented in a manner necessary to cover or isolate all zones which contain hydrocarbons, but in any case, a calculated volume sufficient to fill the annular space at least 500 feet above the uppermost producible hydrocarbon zone must be used. When a liner is used as production casing, the testing of the seal between the liner top and the next larger string shall be conducted as in the case of intermediate liners. The test shall be recorded on the driller's log.

E. *Pressure Testing*. Prior to drilling the plug after cementing, all casing strings, except the drive or structural casing, shall be pressure-tested as shown in the table below. The test pressure shall not exceed the internal yield pressure of the casing. The surface casing shall be tested with water in the top 100 feet of the casing. If the pressure declines more than 10 percent in 30 minutes, or if there is other indication of a leak, the casing shall be recemented, repaired, or an additional casing string run, and the casing shall be tested again in the same manner.

Casing	*Minimum Surface Pressure*
Conductor	200
Surface	1,000
Intermediate	1,500 or 0.2 psi/ft., whichever is greater.
Liner	1,500 or 0.2 psi/ft., whichever is greater.
Production	1,500 or 0.2 psi/ft., whichever is greater.

After cementing any of the above strings, drilling shall not be commenced until a time lapse of eight hours under pressure for conductor casing string or 12 hours under pressure for all other strings. Cement is considered under pressure if one or more float valves are employed and are shown to be holding the cement in place or when other means of holding pressure is used. All casing pressure tests shall be recorded on the driller's log.

F. *Directional Surveys*. Wells are considered vertical if inclination does not exceed an average of three degrees from the vertical. Inclination surveys shall be obtained on all vertical wells at intervals not exceeding 1,000 feet during the normal course of drilling.

Wells are considered directional if inclination exceeds an average of three degrees from the vertical. Directional surveys giving both inclination and azimuth shall be obtained on all directional wells at intervals not exceeding 500 feet during the normal course of drilling and at intervals not exceeding 100 feet in all angle change portions of the hole.

On both vertical and directional wells, directional surveys giving both inclination and azimuth shall be obtained at intervals not exceeding 500 feet prior to, or upon, setting surface or intermediate casing, liners, and at total depth.

Composite directional surveys shall be filed with the District Supervisor. The interval shown will be from the bottom of conductor casing, or, in the absence of conductor casing, from the bottom of drive or structural casing to total depth. In calculating all surveys, a correction from true north to Lambert-Grid north shall be made after making the magnetic to true north correction.

2. *Blowout Prevention Equipment*. Blowout preventers and related well-control equipment shall be installed, used, and tested in a manner necessary to prevent blowouts. Prior to drilling below the drive pipe or structural casing and until drilling operations are completed, blowout prevention equipment shall be installed and maintained ready for use as follows:

A. *Drive Pipe or Structural Casing*. Before drilling below this string, at least one remotely controlled, annular-type blowout preventer or pressure-rotating, pack-off-type head and equipment for circulating the drilling fluid to the drilling structure or vessel shall be installed. When the blowout preventer system is on the Gulf floor, the choke and kill lines or equivalent vent lines, equipped with necessary connections and fittings, shall be used for diversion. An annular preventer or pressure-rotating, pack-off-type head, equipped with suitable diversion lines as described above and installed on top of the marine riser, to permit the diversion of hydrocarbons and other fluids, may be utilized for diversion. A diverter system which provides at least the equivalent of two 4-inch lines (22 square inches internal cross-sectional area) and full-open or butterfly valves shall be installed in order to permit the full diversion of hydrocarbons and other fluids. The diverter system shall be equipped with automatic, remote-controlled valves which open, prior to shutting in the well, at least two lines venting in different directions to accomplish downwind diversion. A schematic diagram and operational procedure for the diverter system shall be submitted with the Application for Permit to Drill (Form 9-331C) to the District Supervisor for approval.

In drilling operations where a floating drill ship or semisubmersible type of drilling vessel is used, and/or where the placement of the initial structural casing is not operationally feasible to provide adequate formation competence to subsequently safely contain shallow hydrocarbons or other fluids while drilling conductor hole, a program which provides for rig and personnel protection and safety in these operations shall be described and submitted to the District Supervisor for his consideration and approval. This program shall include all known pertinent and relevant information, including seismic and geologic data, water depth, drilling-fluid hydrostatic pressure, schematic diagram from rotary table to proposed conductor casing seat, and contingency plan for moving off location. In all areas where shallow hazards or hydrocarbons are unknown, seismic data shall be obtained, and a small-diameter initial pilot hole from the bottom of drive or structural casing to proposed conductor casing seat shall be drilled to determine the presence or absence of these hazards.

B. *Conductor Casing*. Before drilling below this string, at least one remotely controlled, annular-type blowout preventer and equipment for circulating the drilling fluid to the drilling structure or vessel shall be installed. A diverter system as described in paragraph 2A above shall be installed.

C. *Surface Casing*. Before drilling below this string, the blowout prevention equipment shall include a minimum of: (1) three remote-controlled, hydraulically operated blowout preventers with a working pressure which exceeds the maximum anticipated surface pressure, including one equipped with pipe rams, one with blind rams, and one annular type; (2) a drilling spool with side outlets, if side outlets are not provided in the blowout preventer body; (3) a choke line and manifold; (4) a kill line separate from choke line; and (5) a fill-up line.

D. *Intermediate Casing*. Before drilling below this string, the blowout prevention equipment shall include a minimum of: (1) four remote-controlled, hydraulically operated blowout preventers with a working pressure which exceeds the maximum anticipated surface pressure, including at least two equipped with pipe rams, one with blind rams, and one annular type; (2) a drilling spool with side outlets, if side outlets are not provided in the blowout preventer body; (3) a choke line and manifold; (4) a kill line separate from choke line; and (5) a fill-up line.

E. *Testing*.

(1) *Pressure Test.* Ram-type blowout preventers and related control equipment shall be tested with water to the rated working pressure of the stack assembly, with the exception of the annular-type preventer, which shall be tested to 70 percent of the rated working pressure. They shall be tested: (a) when installed, (b) before drilling out after each string of casing is set, (c) not less than once each week from each of the control stations, and (d) following repairs that require disconnecting a pressure seal in the assembly.

(2) *Actuation.* While drill pipe is in use, ram-type blowout preventers shall be actuated to test proper functioning once each trip, but in no event less than once each day. The annular-type blowout preventer shall be actuated on the drill pipe once each week. Accumulators or accumulators and pumps shall maintain a pressure capacity reserve at all times to provide for repeated operation of hydraulic preventers. An operable remote blowout-preventer-control station shall be provided, in addition to the one on the drilling floor.

(3) *Drills.* A blowout prevention drill shall be conducted weekly for each drilling crew to insure that all equipment is operational and that crews are properly trained to carry out emergency duties.

(4) *Records.* All blowout preventer tests and crew drills shall be recorded on the driller's log.

F. *Other Equipment.* An inside blowout-preventer assembly (back-pressure valve) and an essentially full-opening drill-string safety valve in the open position shall be maintained on the rig floor to fit all pipe in the drill string. A kelly cock shall be installed below the swivel, and an essentially full-opening kelly cock of such design that it can be run through the blowout preventers shall be installed at the bottom of the kelly.

3. *Mud Program.* The characteristics, use, and testing of drilling mud and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Quantities of mud materials sufficient to insure well control shall be maintained readily accessible for use at all times.

A. *Mud Control.* Before starting out of the hole with drill pipe, the mud shall be properly conditioned. Proper conditioning requires either circulation with the drill pipe just off bottom to the extent that the annular volume is displaced, or proper documentation in the driller's log prior to pulling the drill pipe that: (1) there was no indication of influx of formation fluids prior to starting to pull the drill pipe from the hole, (2) the weight of the returning mud is not less than the weight of the mud entering the hole, and (3) other mud properties recorded on the daily drilling log are within the specified ranges at the stage of drilling the hole to perform their required functions. In those cases when the hole is circulated, the driller's log shall be so noted.

When coming out of the hole with drill pipe, the annulus shall be filled with mud before the mud level drops 100 feet. A mechanical device for measuring the amount of mud required to fill the hole shall be utilized, and any time there is an indication of swabbing, or influx of formation fluids, the necessary safety devices and action shall be employed to control the well. The mud shall not be circulated and conditioned, except on or near bottom, unless well conditions prevent running the drill pipe back to bottom. The mud in the hole shall be circulated or reverse-circulated prior to pulling drill-stem test tools from the hole.

The hole shall be filled by accurately measured volumes of mud. The number of stands of drill pipe and drill collars that may be pulled between the times of filling the hole shall be calculated and posted. The number of barrels and pump strokes required to fill the hole for this designated number of stands of drill pipe and drill collars shall be posted. For each casing string, the maximum pressure which may be applied to the blowout preventer before controlling excess pressure by bleeding through the choke shall be posted near the driller. Drill pipe pressure shall be monitored during the bleeding procedure for well control.

An operable degasser shall be installed in the mud system prior to the commencement of drilling operations and shall be maintained for use throughout the drilling and completion of the well.

B. *Mud Test Equipment.* Mud test equipment shall be maintained on the drilling rig at all times, and mud tests shall be performed daily, or more frequently as conditions warrant. The following mud-system monitoring equipment shall be installed (with derrick floor indicators) and used at the point in the drilling operation when mud returns are established and throughout subsequent drilling operations:

(1) Recording mud pit level indicator to determine mud pit volume gains and losses. This indicator shall include a visual and audio warning device.

(2) Mud volume measuring device for accurately determining mud volumes required to fill the hole on trips.

(3) Mud return indicator to determine that returns essentially equal the pump discharge rate.

(4) Gas-detecting equipment to monitor the drilling mud returns.

C. *Mud Quantities*. Daily inventories of mud materials, including barite, shall be recorded to provide a basis for determining minimum quantities needed for emergency use. Drilling operations shall be suspended in the absence of minimum quantities of mud materials for emergency use.

4. *Well Control Surveillance and Training*

A. *Surveillance*. From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall maintain rig floor surveillance at all times, unless the well is secured with blowout preventers or cement plugs.

B. *Training*. Company and drilling-contractor supervisory personnel shall be trained in and knowledgeable of present-day well control. The operator shall maintain a record of such training on the facility. Training shall include:

(1) Abnormal pressure detection methods.

(2) Well control operations, including kicks, lost circulation, and trips.

5. *Hydrogen Sulfide*. When drilling operations are undertaken to penetrate reservoirs known or expected to contain hydrogen sulfide (H_2S), or, if unknown, upon encountering H_2S, the following preventive measures shall be taken to control the effects of the toxicity, flammability, and corrosive characteristics of H_2S. Alternative equipment or procedures that achieve the same or greater levels of safety may be approved by the District Supervisor. When sulphur dioxide (SO_2), a product of combustion of H_2S, is present, the procedures outlined in the approved contingency plan required in paragraph 5a(3) of this Order shall be followed.

A. *Personnel Safety and Protection*.

(1) *Training Program*.

(a) All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, shall be informed as to the hazards of H_2S and SO_2. They shall also be instructed in the proper use of personnel safety equipment and informed of H_2S detectors and alarms, ventilation equipment, prevailing winds, briefing areas, warning systems, and evacuation procedures.

(b) Information relating to these safety measures shall be prominently posted on the drilling facility and on vessels in the immediate vicinity which are serving the drilling facility.

(c) To promote efficient safety procedures, an on-site H_2S safety program, which includes a weekly drill and training session, shall be established. Records of attendance shall be maintained on the drilling facility.

(d) All personnel in the working crew shall have been indoctrinated in basic first-aid procedures applicable to victims of H_2S exposure. During subsequent on-site training sessions and drills, emphasis shall be placed upon rescue and first aid for H_2S victims. Each drilling facility shall have the following equipment, and each crew member shall be thoroughly familiar with the location and use of these items:

(i) A first-aid kit.

(ii) Resuscitators, complete with face masks, oxygen bottles, and spare oxygen bottles.

(iii) A Stokes litter or equivalent.

(e) One person, who regularly performs duties on the drilling facility, shall be responsible for the overall operation of the on-site safety and training program.

(2) *Visible Warning System*. Wind direction equipment shall be installed at prominent locations to indicate to all personnel, on or in the immediate vicinity of the facility, the wind direction at all times for determining safe upwind areas in the event that H_2S is present in the atmosphere.

Operational danger signs shall be displayed from each side of the drilling ship or platform, and a number of rectangular red flags shall be hoisted in a manner visible to watercraft and aircraft. Each flag shall be of a minimum width of three feet and a minimum height of two feet. Each sign shall have a minimum width of eight feet and a minimum height of four feet, and shall be painted a high-visibility yellow color with black lettering of a minimum of 12 inches in height, indicating: "DANGER—HYDROGEN SULFIDE—H_2S". All signs and flags shall be illuminated under conditions of poor visibility and at night when in use. These signs and flags shall be displayed to indicate the following operational conditions and requirements:

(a) Moderate Danger. When the threshold limit value of H_2S (10 parts per million) is reached, the signs will be displayed. If the concentration of H_2S reaches 20 parts per million, protective breathing apparatus shall be worn by all personnel, and all nonworking personnel shall proceed to the safe briefing areas.

(b) Extreme Danger. When H_2S is determined to have reached the injurious level (50 parts per million), the flags shall be hoisted in addition to the displayed signs. All nonessential personnel or all personnel, as appropriate, shall be evacuated at this time. Radio communications shall be used to alert all known air- and watercraft in the immediate vicinity of the drilling facility.

(3) *Contingency Plan*. A contingency plan shall be developed prior to the commencement of drilling operations. The plan shall include the following:

(a) General information and physiological response to H_2S and SO_2 exposure.

(b) Safety procedures, equipment, training, and smoking rules.

(c) Procedures for operation conditions:

(i) Moderate danger to life.

(ii) Extreme danger to life.

(d) Responsibilities and duties of personnel for each operation condition.

(e) Designation of briefing areas as locations for assembly of personnel during Extreme Danger condition. At least two briefing areas shall be established on each drilling facility. Of these two areas, the one upwind at any given time is the safe briefing area.

(f) Evacuation plan.

(g) Agencies to be notified in case of an emergency.

(h) A list of medical personnel and facilities, including addresses and telephone numbers.

(4) *H_2S Detection and Monitoring Equipment*. Each drilling facility shall have an H_2S detection and monitoring system which activates audible and visible alarms before the concentration of H_2S exceeds its threshold limit value of 10 parts per million in air. This equipment shall be capable of sensing a minimum of five parts per million H_2S in air, with sensing points located at the bell nipple, shale shaker, mud pits, driller's stand, living quarters, and other areas where H_2S might accumulate in hazardous quantities.

H_2S detector ampules shall be available for use by all working personnel. After H_2S has been initially detected by any device, frequent inspections of all areas of poor ventilation shall be made with a portable H_2S-detector instrument.

(5) *Personnel Protective Equipment*.

(a) All personnel on a drilling facility or aboard marine vessels serving the facility shall be equipped with proper personnel protective-breathing apparatus. The protective breathing apparatus used in an H_2S environment shall conform to all applicable Occupational Safety and Health Administration regulations and American National Standards Institute standards. Optional equipment, such as nose cups and spectacle kits, shall be available for use as needed.

(b) The storage location of protective breathing apparatus shall be such that they are quickly and easily available to all personnel. Storage locations shall include the following:

(i) Rig floor.

(ii) A working area above the rig floor.

(iii) Mud-logging facility.

(iv) Shale-shaker area.

(v) Mud pit area.

(vi) Mud storage area.

(vii) Pump rooms (mud and cement).

(viii) Crew quarters.

(ix) Each briefing area.

(x) Heliport.

(c) A system of breathing-air manifolds, hoses, and masks shall be provided on the rig floor and in the briefing areas. A cascade air-bottle system shall be provided to refill individual protective-breathing-apparatus bottles. The cascade air-bottle system may be recharged by a high-pressure compressor suitable for providing breathing-quality air, provided the compressor suction is located in an uncontaminated atmosphere. All breathing-air bottles shall be labeled as containing breathing-quality air fit for human usage.

(d) Workboats attendant to rig operations shall be equipped with protective breathing apparatus for all workboat crew members. Pressure-demand or demand-type masks, connected to a breathing-air manifold, and additional protective breathing apparatus shall be available for evacuees. Whenever possible, boats shall be stationed upwind.

(e) Helicopters attendant to rig operations shall be equipped with a protective breathing apparatus for the pilot.

(f) The following additional personnel safety equipment shall be available for use as needed:

(i) Portable H_2S detectors.

(ii) Retrieval ropes with safety harnesses to retrieve incapacitated personnel from contaminated areas.

(iii) Chalk boards and note pads located on the rig floor, in the shale-shaker area, and in the cement pump rooms for communication purposes.

(iv) Bull horns and flashing lights.

(v) Resuscitators.

(6) *Ventilation Equipment.* All ventilation devices shall be explosion-proof and situated in areas where H_2S or SO_2 may accumulate. Movable ventilation devices shall be provided in work areas and be multidirectional and capable of dispersing H_2S or SO_2 vapors away from working personnel.

(7) *Notification of Regulatory Agencies.* The following agencies shall be immediately notified under the alert conditions indicated:

(a) *Moderate Danger.*

(i) U. S. Geological Survey

(ii) U. S. Coast Guard

(b) *Extreme Danger.*

(i) U. S. Geological Survey.

(ii) U. S. Coast Guard

(iii) Department of Defense (when operating in Department of Defense warning areas in the northeast Gulf of Mexico).

(iv) Appropriate State agencies.

B. *Metallurgical Equipment Considerations.* Equipment used when drilling zones bearing H_2S shall be constructed of materials which, according to design principles, will be able to resist damage from the phenomena known variously as sulfide stress cracking, hydrogen embrittlement, or stress corrosion cracking. Such equipment includes drill pipe, casing, casing heads, blowout-preventer stack assemblies, kill lines, choke manifolds, and other related equipment. A knowledge of the various interactions between stress, environment, and the metallurgy employed is required for successful operation in H_2S environments. The following general practices are required for acceptable performance:

(1) *Drill String.* Drill strings shall be designed consistent with the anticipated depth, conditions of the hole, and reservoir environment to be encountered. Care shall be taken to minimize exposure of the drill string to high stresses as much as is practical and consistent with the anticipated hole conditions to be encountered.

(2) *Casing.* Casing, couplings, flanges, and related equipment shall be designed for H_2S service. Field welding on casing (except conductor and surface strings) is prohibited unless approved by the District Supervisor.

(3) *Wellhead, Blowout Preventers, and Pressure Control Equipment.* The blowout preventer stack assembly shall be designed in accordance with criteria evolved through technology of the latest state-of-the-art for H_2S service. Surface equipment such as choke lines, choke manifold, kill lines, bolting, weldments, and other related well-killing equipment shall be designed and fabricated utilizing the most advanced technology concerning sulfide stress cracking. Elastomers, packing, and similar inner parts exposed to H_2S shall be resistant at the maximum anticipated temperature of exposure.

C. *Mud Program.*

(1) Either water- or oil-base muds are suitable for use in drilling formations containing H_2S. If oil-base muds are used, cuttings shall be cleaned of oil prior to disposal into Gulf waters.

(2) A pH of 10.0 or above shall be maintained in a water-base mud system to control corrosion and prevent sulfide stress cracking.

(3) Consideration shall also be given to the use of H_2S scavengers in both water- and oil-base mud systems.

(4) Sufficient quantities of additives shall be maintained on location for addition to the mud system as needed to neutralize H_2S picked up by the system when drilling in formations containing H_2S.

(5) The application of corrosion inhibitors to the drill pipe to afford a protective coating or their addition to the mud system may be used as an additional safeguard to the normal protection of the metal by pH control and the scavengers mentioned above.

(6) Drilling mud containing H_2S gas shall be degassed at the optimum location for the particular rig configuration employed. The gases so removed shall be piped into a closed flare system and burned at a suitable remote stack.

D. *General Operations.* All personnel in the working area shall utilize H_2S protective-breathing apparatus when required, as specified in paragraph 5A(2). The normal fixed-point monitor system outlined in paragraph 5A(4) may be supplemented with portable H_2S detectors as conditions warrant.

(1) *Drill String Trips or Fishing Operations.* Every effort shall be made to pull a dry drill string while maintaining well control. If it is necessary to pull the drill string wet after penetration of H_2S-bearing zones, increased monitoring of the working area shall be provided and protective breathing apparatus shall be worn under conditions as outlined in paragraph 5A(2).

(2) *Circulating Bottoms-up from a Drilling Break, Cementing Operations, Logging Operations, or Well Circulation While Not Drilling.* After penetration of an H_2S-bearing zone, protective breathing apparatus shall be worn by those personnel in the working area in advance of circulating bottoms-up or when H_2S is indicated by the monitoring system in quantities sufficient to require protective breathing apparatus under paragraph 5A(2), should this condition occur earlier.

(3) *Coring Operations in H_2S-bearing Zones.* Personnel protective-breathing apparatus shall be worn 10-20 stands in advance of retrieving the core barrel. Cores to be transported shall be sealed and marked for the presence of H_2S.

(4) *Abandonment or Temporary Abandonment Operations.* Internal well-abandonment equipment shall be designed for H_2S service.

(5) *Logging Operations after Penetration of Known or Suspected H_2S-bearing Zones.* Mud in use for logging operations shall be conditioned and treated to minimize the effects of H_2S on the logging equipment.

(6) *Stripping Operations.* Displaced mud returns shall be monitored and protective breathing apparatus worn if H_2S is detected at levels outlined for protective breathing apparatus under paragraph 5A(2).

(7) *Gas-cut Mud or Well Kick from H_2S-bearing Zones.* Protective breathing apparatus shall be worn when an H_2S concentration of 20 parts per million is detected. Should a decision be made to circulate out a kick, protective breathing apparatus shall be worn prior to and subsequent to bottoms-up, and at any time during an extended kill operation that the concentration of H_2S becomes hazardous to personnel as defined in paragraph 5A(2)(a).

(8) *Drill String Precautions.* Precautions shall be taken to minimize drill string stresses caused by conditions such as excessive dogleg severity, improper stiffness ratios, improper torque, whip, abrasive wear on tool joints, and joint imbalance. American Petroleum Institute Bulletin RP 7G shall be used as a guideline for drill string precautions. Tool-joint compounds containing free sulphur shall not be used. Proper handling techniques shall be employed to minimize notching, stress concentrations, and possible drill pipe failures.

(9) *Flare System.* The flare system shall be designed to safely gather and burn H_2S gas. Flare lines shall be located as far from the drilling facility as feasible in a manner to compensate for wind changes. The flare system shall be equipped with a pilot and an automatic igniter. Backup ignition for each flare shall be provided.

E. *Kick Detection and Well Control.* In addition to the requirements of paragraph 3B of this Order, all efforts shall be made to prevent a well kick as a result of gas-cut mud, drilling breaks, lost circulation, or trips for bit change. Drilling rate changes shall be evaluated for the possibility of encountering abnormal pressures, and mud weights adjusted in an effort to compensate for any hydrostatic imbalance that might result in a well kick.

In the event of a kick, the disposal of the well influx fluids shall be accomplished by one of the following alternatives, giving consideration to personnel safety, possible environmental damage, and possible facility well equipment damage:

Alternative A. To contain the well fluid influx by shutting in the well and pumping the fluids back into the formation.

Alternative B. To control the kick by using appropriate well-control techniques to prevent formation fracturing in open hole within the pressure limits of well equipment (drill pipe, casing, wellhead, blowout preventers, and related equipment). The disposal of H_2S and other gases shall be through pressured or atmospheric mud-gas separator equipment, depending on volume and pressure of H_2S gas. The equipment shall be designed to recover drilling mud and to vent to the atmosphere and burn the gases separated. The mud system shall be treated to neutralize H_2S and restore and maintain the proper mud quality.

F. *Well Testing in an H_2S Environment.*

(1) *Procedures.*

(a) Well testing shall be performed with a minimum number of personnel in the immediate vicinity of the rig floor and test equipment to safely and adequately perform the test and maintain related equipment and services.

(b) Prior to initiation of the test, special safety meetings shall be conducted for all personnel who will be on the drill facility during the test, with particular emphasis on the use of personnel protective-breathing apparatus, first aid procedures, and the H_2S Contingency Plan.

(c) During the test, the use of H_2S detection equipment shall be intensified. All produced gases shall be vented and burned through a flare system which meets the requirements of paragraph 5D(9). Gases from stored test fluids shall be vented into the flare system.

(d) "No Smoking" rules in the approved Contingency Plan of paragraph 5A(3) of this Order shall be rigorously enforced.

(2) *Equipment*.

(a) Drill-stem test tools and wellhead equipment shall be suitable for H_2S service.

(b) Tubing which meets the requirements for H_2S service shall be used for drill stem testing. Drill pipe shall not be used for drill stem tests without the prior approval of the District Supervisor. The water cushion shall be thoroughly inhibited in order to prevent H_2S corrosion. The test string shall be flushed with treated fluid for the same purpose after completion of the test.

(c) All surface test units and related equipment shall be designed for H_2S service. Only competent personnel who are trained in and knowledgeable of the hazardous effects of H_2S shall be utilized in these tests.

/s/ D. W. SOLANAS
Oil and Gas Supervisor
Field Operations
Gulf of Mexico Area

APPROVED: NOVEMBER 25, 1974

/s/ RUSSELL G. WAYLAND
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 3
Effective August 28, 1969

PLUGGING AND ABANDONMENT OF WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.15. The operator shall comply with the following minimum plugging and abandonment procedures which have general application to all wells drilled for oil and gas. Plugging and abandonment operations must not be commenced prior to obtaining approval from an authorized representative of the Geological Survey. Oral approvals shall be in accordance with 30 CFR 250.13. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Permanent Abandonment.*

A. *Isolation in Uncased Hole.* In uncased portions of wells, cement plugs shall be spaced to extend 100 feet below the bottom to 100 feet above the top of any oil, gas and fresh water zones so as to isolate them in the strata in which they are found and to prevent them from escaping into other strata.

B. *Isolation of Open Hole.* Where there is open hole (uncased and open into the casing string above) below the casing, a cement plug shall be placed in the deepest casing string by (1) or (2) below, or in the event lost circulation conditions exist or are anticipated, the plug may be placed in accordance with (3) below:

(1) A cement plug placed by displacement method so as to extend a minimum of 100 feet above and 100 feet below the casing shoe.

(2) A cement retainer with effective back pressure control set not less than 50 feet nor more than 100 feet, above the casing shoe with a cement plug calculated to extend at least 100 feet below the casing shoe and 50 feet above the retainer.

(3) A permanent type bridge plug set with 150 feet above the casing shoe with 50 feet of cement on top of the bridge plug. This plug shall be tested prior to placing subsequent plugs.

C. *Plugging or Isolating Perforated Intervals.* A cement plug shall be placed opposite all open perforations (perforations not squeezed with cement) extending a minimum of 100 feet above and 100 feet below the perforated interval or down to a casing plug whichever is less. In lieu of the cement plug, a bridge plug set at a maximum of 150 feet above the open perforations with 50 feet of cement on top may be used provided the perforations are isolated from the hole below.

D. *Plugging of Casing Stubs.* If casing is cut and recovered, a cement plug 200 feet in length shall be placed to extend 100 feet above and 100 feet below the stub. A retainer may be used in setting the required plug.

E. *Plugging of Annular Space.* No annular space that extends to the Gulf floor shall be left open to drilled hole below. If this condition exists, the annulus shall be plugged with cement.

F. *Surface Plug Requirement.* A cement plug of at least 150 feet, with the top of the plug 150 feet or less below the Gulf floor, shall be placed in the smallest string of casing which extends to the surface.

G. *Testing of Plugs.* The setting and location of the first plug below the top 150-foot plug, will be verified by either (1) placing a minimum pipe weight of 15,000 pounds on the plug, or (2) testing with a minimum pump pressure of 1,000 psig with no more than a 10 percent pressure drop during a 15-minute period.

H. *Mud.* Each of the respective intervals of the hole between the various plugs shall be filled with mud fluid of sufficient density to exert hydrostatic pressure exceeding the greatest formation pressure encountered while drilling such interval.

I. *Clearance of Location.* All casing and piling shall be severed and removed to at least 15 feet below the Gulf floor and the location shall be dragged to clear the well site of any obstructions.

2. *Temporary Abandonment.* Any drilling well which is to be temporarily abandoned shall be mudded and cemented as required for permanent abandonment except for requirements F and I of paragraph 1 above. When casing extends above the Gulf floor, a mechanical bridge plug (retrievable or permanent) shall be set in the casing between 15 and 200 feet below the Gulf floor.

/s/ ROBERT F. EVANS
Supervisor

APPROVED: AUGUST 28, 1969

/s/ RUSSELL G. WAYLAND
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 4

Effective August 28, 1969

SUSPENSIONS AND DETERMINATION OF WELL PRODUCIBILITY

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.12(d)(1). An OCS lease provides for extension beyond its primary term for as long as oil or gas may be produced from the lease in paying quantities. An OCS lease may be maintained beyond the primary term, in the absence of actual production, when a suspension of operations or production, or both, has been approved. An application for suspension of production for an initial period should be submitted prior to the expiration of the term of a lease. The supervisor may approve a suspension of production provided at least one well has been drilled on the lease and determined to be capable of being produced in paying quantities. The temporary or permanent abandonment of a well will not preclude approval of a suspension of production as provided in 30 CFR 250.12(d)(1). Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

A well may be determined to be capable of producing in paying quantities when the requirements of either 1 or 2 below have been met.

1. *Production Tests.*

A. *Oil Wells.* A production test of at least two hours duration, following stabilization, is required.

B. *Gas Wells.* A deliverability test of at least two hours duration, following stabilization, or a four-point back-pressure test, is required.

C. *Witnessing and Results.* All tests must be witnessed by an authorized representative of the Geological Survey. Test data accompanied by operator's affidavit, or third-party test data, may be accepted in lieu of a witnessed test provided prior approval is obtained from the appropriate district office. The results of the witnessed or accepted test must justify a determination that the well is capable of producing in paying quantities.

2. *Production Capability.* Information for determining producibility should be submitted in time to permit one week for evaluation and determination. In cases of urgency, determinations may be conveyed orally. The following may be considered as acceptable evidence that a well is capable of producing in paying quantities:

A. An induction-electric log of the well, clearly showing a minimum of 15 feet of producible sand in one section which does not include any interval which appears to be water saturated. All of the section counted as producible must exhibit the following properties:

(1) Electrical spontaneous potential exceeding 20 negative millivolts beyond the shale base line. If mud conditions prevent a 20 negative millivolt reading beyond the shale base line, a gamma ray log deflection of at least 70 percent of the maximum gamma ray deflection in the nearest clean water bearing sand may be substituted.

(2) A minimum true resistivity ratio of the producible section to the nearest clean water sand of at least 5:1, provided the producible section exhibits a minimum resistivity of 2.0 ohm-meters.

(3) A porosity log indicating porosity in the producible section.

B. Sidewall cores and core analysis which indicates that the section is producible.

C. A wire line formation test or evidence that an attempt was made to obtain such test. The test results must indicate that the section is producible.

D. All logs run must support other evidence that the section is producible.

/s/ Robert F. Evans
Supervisor

Approved: August 28, 1969

/s/ Russell G. Wayland
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 5
Effective June 5, 1972

SUBSURFACE SAFETY DEVICES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.41(b). Section 250.41(b) provides as follows:

(b) Completed Wells. In the conduct of all its operations, the lessee shall take all steps necessary to prevent blowouts, and the lessee shall immediately take whatever action is required to bring under control any well over which control has been lost. The lessee shall: (1) in wells capable of flowing oil or gas, when required by the supervisor, install and maintain in operating condition storm chokes or similar subsurface safety devices; (2) for producing wells not capable of flowing oil or gas, install and maintain surface safety valves with automatic shutdown controls; and (3) periodically test or inspect such devices or equipment as prescribed by the supervisor.

The operator shall comply with the following requirements. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b). All applications for approval under the provisions of this Order shall be submitted to the appropriate District office. References in this Order to approvals, determinations, or requirements are to those given or made by the Supervisor or his delegated representative.

1. *Installation.* All new and existing tubing installations open to hydrocarbon-bearing zones shall be equipped with a subsurface-controlled or a surface- or other remotely controlled subsurface safety device, to be installed at a depth of 100 feet or more below the sea floor unless, after application and justification, the well is determined to be incapable of flowing oil or gas. These installations shall be made as required in subparagraphs A and B below within two (2) days after stabilized production is established, and during this period of time the well shall not be left unattended while open to production.

A. *New Wells.* All tubing installations in wells completed after December 1, 1972, shall be equipped with a surface- or other remotely controlled subsurface safety device; provided, that wells with a shut-in tubing pressure of 4,000 psig or greater shall be equipped with a subsurface-controlled subsurface safety device in lieu of a surface- or other remotely controlled subsurface safety device unless a surface- or other remotely controlled subsurface safety device is approved or required. When the shut-in tubing pressure declines below 4,000 psig, a surface- or other remotely controlled subsurface safety device shall be installed when the tubing is first removed and reinstalled.

B. *Existing Wells.* All tubing installations in wells existing on the date of this Order shall be equipped with a surface- or other remotely controlled subsurface safety device when the tubing is first removed and reinstalled after December 1, 1972; provided, that wells with a shut-in tubing pressure of 4,000 psig or greater shall be equipped with a subsurface-controlled subsurface safety device in lieu of a surface- or other remotely controlled subsurface safety device unless a surface- or other remotely controlled subsurface safety device is approved or required. When the shut-in tubing pressure declines below 4,000 psig, a surface- or other remotely controlled subsurface safety device shall be installed when the tubing is first removed and reinstalled.

Tubing installations in existing wells completed from single-well and multi-well satellite caissons or jackets and sea-floor completions may be equipped with a subsurface-controlled subsurface safety device, in lieu of a surface- or other remotely controlled subsurface safety device, upon application, justification, and approval.

C. *Shut-in Wells.* A tubing plug shall be installed in lieu of, or in addition to, other subsurface safety devices if a well has been shut in for a period of six (6) months. Such plugs shall be set at a depth of 100 feet or more below the sea floor. All retrievable plugs installed after the date of this Order shall be of the pump-through type. All wells perforated and completed, but not placed on production, shall be equipped with a subsurface safety device or tubing plug within two (2) days after completion.

D. *Injection Wells*. Subsurface safety devices as required in subparagraphs A and B above shall be installed in all injection wells unless, after application and justification, it is determined that the well is incapable of flowing oil or gas, which condition shall be verified annually.

2. *Technological Advancement*. As technological research, progress, and product improvement result in increased effectiveness of existing safety devices or the development of new devices or systems, such devices or systems may be required or used upon application, justification, and approval. Applications for routine use shall include evidence that the device or system has been field-tested at least once each month for a minimum of six (6) consecutive months, and that each test indicated proper operation.

3. *Testing and Inspection*. Subsurface safety devices shall be designed, adjusted, installed, and maintained to insure reliable operation. During testing and inspection procedures, the well shall not be left unattended while open to production unless a properly operating subsurface safety device has been installed in the well.

A. *Surface-Controlled Subsurface Safety Devices*. Each surface- or other remotely controlled subsurface safety device installed in a well shall be tested in place for proper operation when installed and thereafter at intervals not exceeding six (6) months. If the device does not operate properly, it shall be removed, repaired, and reinstalled or replaced and tested to insure proper operation.

B. *Subsurface-Controlled Subsurface Safety Devices*. Each subsurface-controlled subsurface safety device installed in a well shall be removed, inspected, and repaired or adjusted as necessary and reinstalled at intervals not exceeding six (6) months; provided, that such removable devices set in a landing nipple shall be removed, inspected, and repaired or adjusted as necessary and reinstalled at intervals not exceeding twelve (12) months. Each velocity-type device shall be designed to close at a flow rate not to exceed the larger of either 150 percent of, or 200 BFPD above, the most recent well-test rate which equals or exceeds the approved production rate. The above closing flow rate shall not exceed the calculated capacity of the well to produce against a flowing wellhead pressure of 50 psig. Each preset tubing-pressure-actuated device shall be designed to close prior to reduction of the flowing wellhead pressure to 50 psig.

C. *Tubing Plugs*. A shut-in well equipped with a tubing plug shall be inspected for leakage by opening the well to possible flow at intervals not exceeding six (6) months. If sustained liquid flow exceeds 400 cc/min., or gas flow exceeds 15 cu. ft./min., the plug shall be removed, repaired, and reinstalled or an additional tubing plug installed to prevent leakage.

4. *Temporary Removal*. Each wireline- or pumpdown-retrievable subsurface safety device may be removed, without further authority or notice, for a routine operation which does not require approval of a Sundry Notice and Report on Wells (Form 9-331) for a period not to exceed fifteen (15) days. The well shall be clearly identified as being without a subsurface safety device and shall not be left unattended while open to production. The provisions of this paragraph are not applicable to the testing and inspection procedures in paragraph 3 above.

5. *Additional Protective Equipment*. All tubing installations made after the date of this Order in which a wireline- or pumpdown-retrievable subsurface safety device is to be installed shall be equipped with a landing nipple, with flow couplings or other protective equipment above and below, to provide for setting of the subsurface safety device. All wells in which a subsurface safety device or tubing plug is installed shall have the tubing-casing annulus packed off above the uppermost open casing perforation. The control system for all surface-controlled subsurface safety devices shall be an integral part of the platform shut-in system, or of an independent remote shut-in system.

6. *Departures*. All departures (or waivers) approved prior to the date of this Order are hereby terminated as of December 1, 1972, unless new applications are submitted prior to that date. All such new applications will be considered for approval pursuant to 30 CFR 250.12(b) and the requirements of this Order. All applications for departures shall include a detailed statement of the well conditions, efforts made to overcome any difficulties, and proposed alternate safety measures.

7. *Emergency Action*. All tubing installations open to hydrocarbon-bearing zones and not equipped with a subsurface safety device as permitted by this Order shall be clearly identified as not being so equipped, and a subsurface safety device or tubing plug shall be available at the field location. In the event of an emergen-

cy, such as an impending hurricane, such device or plug shall be promptly installed within the limits of practicability, due consideration being given to personnel safety.

8. *Records*. The operator shall maintain the following records for a minimum period of one year for each subsurface safety device and tubing plug installed, which records shall be available to any authorized representative of the Geological Survey.

A. *Field Records*. Individual well records shall be maintained at or near the field and shall include, as a minimum, the following information:

(1) A record which will give design and other information; i.e., make, model, type, spacers, bean and spring size, pressure, etc.

(2) Verification of assembly by a qualified person in charge of installing the device and installation date.

(3) Verification of setting depth and all operational tests as required in this Order.

(4) Removal date, reason for removal, and reinstallation date.

(5) A record of all modifications of design in the field.

(6) All mechanical failures or malfunctions, including sandcutting, of such devices, with notation as to cause or probable cause.

(7) Verification that a failure report was submitted.

B. *Other Records*. The following records, as a minimum, shall be maintained at the operator's office:

(1) Verified design information of subsurface-controlled subsurface safety devices for the individual well.

(2) Verification of assembly and installation according to design information.

(3) All failure reports.

(4) All laboratory analysis reports of failed or damaged parts.

(5) Quarterly failure-analysis report.

9. *Reports*. Well completion report (Form 9-330) and any subsequent reports of workover (Form 9-331) shall include the type and the depth of the subsurface safety devices and tubing plugs installed in the well or indicate that a departure has been granted.

To establish a failure-reporting and corrective-action program as a basis for reliability and quality control, each operator shall submit a quarterly failure-analysis report to the office of the Supervisor, identifying mechanical failure by lease and well, make and model, cause or probable cause of failure, and action taken to correct the failure. The reporting period shall begin the first day of the month following the date of this Order. The reports shall be submitted by February 28, May 31, August 31, and November 30 for the periods ending January 31, April 30, July 31, and October 31 of each year.

/s/ ROBERT F. EVANS
Supervisor

APPROVED: JUNE 5, 1972

/s/ RUSSELL G. WAYLAND
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION

GULF OF MEXICO AREA

OCS ORDER NO. 6

Effective August 28, 1969

COMPLETION OF OIL AND GAS WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.92. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Wellhead Equipment and Testing Procedures.*

A. *Wellhead Equipment.* All completed wells shall be equipped with casingheads, wellhead fittings, valves and connections with a rated working pressure equal to or greater than the surface shut-in pressure of the well. Connections and valves shall be designed and installed to permit fluid to be pumped between any two strings of casing. Two master valves shall be installed on the tubing in wells with a surface pressure in excess of five thousand pounds per square inch. All wellhead connections shall be assembled and tested, prior to installation, by a fluid pressure which shall be equal to the rated test pressure of the fitting to be installed.

B. *Testing Procedure.* Any wells showing sustained Pressure on the casinghead, or leaking gas or oil between the production casing and the next larger casing string, shall be tested in the following manner: The well shall be killed with water or mud and pump pressure applied. Should the pressure at the casinghead reflect the applied pressure, the casing shall be condemned. After corrective measures have been taken, the casing shall be tested in the same manner. This testing procedure shall be used when the origin of the pressure cannot be determined otherwise.

2. *Storm Choke.* All completed wells shall meet the requirements prescribed in OCS Order No. 5.

3. *Procedures for Multiple or Tubingless Completions.*

A. *Multiple Completions.*

(1) Information shall be submitted on, or attached to, Form 9-331 showing top and bottom of all zones proposed for completion or alternate completion, including a partial electric log and a diagrammatic sketch showing such zones and equipment to be used.

(2) When zones approved for multiple completion become intercommunicated the lessee shall immediately repair and separate the zones after approval is obtained.

B. *Tubingless Completions.*

(1) All tubing strings in a multiple completed well shall be run to the same depth below the deepest producible zone.

(2) The tubing string(s) shall be new pipe and cemented with a sufficient volume to extend a minimum of 500 feet above the uppermost producible zone.

(3) A temperature or cement bond log shall be run in all tubingless completion wells where lost circulation or other unusual circumstances occur during the cementing operations.

(4) Information shall be submitted on, or attached to, Form 9-331 showing the top and bottom of all zones proposed for completion or alternate completion, including a partial electric log and a diagrammatic sketch showing such zones and equipment to be used.

/s/ ROBERT F. EVANS
Supervisor

APPROVED: AUGUST 28, 1969

/s/ RUSSELL G. WAYLAND
Chief Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION

GULF OF MEXICO AREA

OCS ORDER NO. 7

Effective October 1, 1976

POLLUTION AND WASTE DISPOSAL

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.43. The operator shall comply with the following requirements. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b).

1. *Pollution prevention*. In the conduct of all oil and gas operations, the operator shall prevent pollution of the Gulf. Furthermore, the disposal of waste materials into the Gulf shall not create conditions which will adversely affect the public health, life or property, aquatic life or wildlife, recreation, navigation, or other uses of the Gulf.

A. *Liquid disposal*.

(1) Drilling mud containing free oil shall not be disposed of into the Gulf.

(2) The operator shall submit with the Application for Permit to Drill (Form 9-331 C) a detailed list of drilling mud components, including the common chemical or chemical trade name of each component, and a list of the drilling mud additives anticipated for use in meeting special drilling requirements. Disposal of drilling mud shall be by methods which will minimize the adverse effects to marine life. These methods shall be consistent with applicable Federal regulations. Approval of drilling mud disposal procedures will be site specific and on a case-by-case basis.

(3) Curbs, gutters, and drains on platforms and structures shall be installed and maintained in accordance with the provisions of OCS Order No. 8.

(4) Discharges from fixed structures, including sanitary waste, produced water, and deck drainage, are subject to the Environmental Protection Agency's permitting procedures pursuant to the Federal Water Pollution Control Act, as amended.

B. *Solid waste disposal*.

(1) Drill cuttings, sand, and other solids containing oil shall not be disposed of into the Gulf unless all of the free oil has been removed.

(2) Mud containers and other similar solid waste materials shall be incinerated or transported to shore for disposal in accordance with Federal, State, or local requirements.

2. *Personnel, inspections, and reports*.

A. *Personnel*. The operator's personnel shall be thoroughly instructed in the techniques of equipment maintenance and operation for the prevention of pollution. Nonoperator personnel shall be informed in writing, prior to executing contracts, of the operator's obligations to prevent pollution.

B. *Pollution inspections*.

(1) Manned facilities shall be inspected daily.

(2) Unattended facilities, including those equipped with remote control and monitoring systems, shall be inspected at frequent intervals. The District Supervisor may prescribe the frequency of inspections for these facilities.

(3) All production facilities, such as separators, tanks, treaters, and other hydrocarbon handling equipment shall be designed and operated in a manner necessary to prevent pollution. Maintenance or repairs as are necessary to prevent pollution of the Gulf shall be undertaken immediately.

C. *Pollution reports*.

(1) All spills of oil and liquid pollutants shall be recorded showing the cause, size of spill, and action taken, and the record shall be maintained and available for inspection by the District Supervisor. All spills of less than 2.4 cubic meters (15 barrels) shall be reported orally to the District Supervisor within 12 hours and shall be confirmed in writing.

(2) All spills of oil and liquid pollutants of 2.4 to 7.9 cubic meters (15 to 50 barrels) shall be reported orally to the District Supervisor within four (4) hours and shall be confirmed in writing.

(3) All spills of oil and liquid pollutants of more than 7.9 cubic meters (50 barrels) shall be reported orally without delay to the District Supervisor and the Coast Guard. All oral reports shall be confirmed in writing.

(4) Operators shall notify each other upon observation of equipment malfunction or pollution resulting from another's operation.

3. *Pollution-control equipment and oil spill contingency plan.*

A. *Equipment*. Standby pollution-control equipment and materials shall be maintained by, or shall be available to, each operator at an offshore or onshore location. This shall include containment booms, skimming apparatus, cleanup materials, and chemical agents, and shall be available prior to the commencement of operations. The use of chemicals shall be permitted only after approval by the Area Supervisor in accordance with Part 2003.2-1 Annex X, National Oil and Hazardous Substances Pollution Contingency Plan. The equipment and materials shall be inspected monthly and maintained in good condition for use. The results of the inspections shall be recorded and maintained at the site.

B. *Oil spill contingency plan.* The operator shall submit an oil spill contingency plan for approval by the Area Supervisor before consideration can be given to approval of an application for permit to conduct operations. This plan shall contain the following:

(1) Provisions to assure that full resource capability is known and can be committed during an oil discharge situation including the identification and inventory of applicable equipment, materials, and supplies which are available locally and regionally, both committed and uncommitted, and the time required for deployment.

(2) Provisions for varying degrees of response effort depending on the severity of the oil discharge.

(3) Establishment of notification procedures for the purpose of early detection and timely notification of an oil discharge including a current list of names, telephone numbers, and addresses of the responsible persons and alternates on call to receive notification of an oil discharge, as well as the names, telephone numbers and addresses of regulatory organizations and agencies to be notified when an oil discharge is discovered.

(4) Provisions for well defined and specific actions to be taken after discovery and notification of an oil discharge including:

(a) Specification of an oil discharge response operating team consisting of trained, prepared, and available operating personnel.

(b) Predesignation of an oil discharge response coordinator who is charged with the responsibility and delegated commensurate authority for directing and coordinating response operations.

(c) A preplanned location for an oil discharge response operations center and a reliable communications system for directing the coordinated overall response operations.

4. *Spill control and removal.* Immediate corrective action shall be taken in all cases where pollution has occurred. Corrective action taken under the Oil Spill Contingency Plan shall be subject to modification when directed by the Area Supervisor. The primary jurisdiction to require corrective action to abate the source of pollution and to enforce the subsequent cleanup by the lessee or operator shall remain with the Area Supervisor pursuant to the provisions of this Order and the memorandum of understanding between the Department of Transportation (U.S. Coast Guard) and the Department of the Interior (U.S. Geological Survey) dated August 16, 1971.

5. *Annual contingency plan assessment.* Annual contingency plan assessments will be conducted in conjunction with the Plan of Development review. Upon request of the Area Supervisor, revised contingency plans reflecting changes in personnel, equipment, and methods shall be submitted.

/s/ D. W. Solanas,
Area Oil and Gas Supervisor

Approved:

/s/ Russell G. Wayland,
Acting Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 8
Effective October 1, 1976

PLATFORMS, STRUCTURES, AND ASSOCIATED EQUIPMENT

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.19(a). Section 250.19(a) provides as follows:

(a) The supervisor is authorized to approve the design, other features, and plan of installation of all platforms, fixed structures, and artificial islands as a condition of the granting of a right of use or easement under Paragraphs (a) and (b) of Section 250.18 or authorized under any lease issued or maintained under the Act.

The operator shall be responsible for compliance with the requirements of this Order in the installation and operation of all platforms and structures, including all facilities installed on a platform or structure, whether or not operated or owned by the operator. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b). All applications for approval under the provisions of this Order shall be submitted to the appropriate District Supervisor. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Oil and Gas Supervisor or his delegated representative.

Following approval of applications, installations and operations shall be performed as approved. If deemed advisable, significant changes to approved applications may be proposed; however, approval of such proposals shall be required prior to implementation. For the purposes of compliance with this paragraph, a significant change in any structural change which materially alters the original plan or any major deviation from operations as originally approved. Any question as to whether a change is significant enough to require approval shall be referred to the USGS. An operator assumes the risk for making changes without approval if he fails to contact the USGS to determine whether a permit is necessary.

The following requirements are applicable to all platforms and structures approved and installed subsequent to the effective date of the Order. When structural or equipment modifications to existing platforms and structures are proposed, only requirements relevant to the modifications shall be applicable.

1. *Platform Design.*

A. *General Design.* A platform or structure shall be designed for safe installation and operation for its intended use and service life at a specific site. Steel structures shall be designed in accordance with those provisions of API RP 2A, "Planning, Designing and Constructing Fixed Offshore Platforms," Seventh Edition, January 1976, or subsequent revisions as approved by the Area Supervisor. The design of structures other than steel shall be evaluated on an individual basis. Consideration shall be given to conditions which may contribute to structural damage such as:

(1) Wind, wave, and current forces and other environmental loading forces.

(2) Functional loading conditions including the weight of the structure and all permanently fixed equipment, and the effects of static and dynamic functional load conditions during installation and the design operational service period.

(3) Water depth, bottom topography, surface and subsurface soil conditions, slope stability, scour conditions, and other pertinent geologic conditions based on information from on-site investigations.

2. *Application.* Prior to installation of a fixed platform or structure, the operator shall submit

for approval, in duplicate, an application showing essential features of the platform or structure and supporting design information as follows:

A. *General Information*

(1) Identification data, which shall include the platform or structure designation, lease number, area name, block number, and operator.

(2) Location data, including plat showing the distance from the nearest two-block lines.

(3) Primary use and other intended functions, including planned drilling, production, and storage operations.

(4) Personnel facilities, personnel access to living quarters, boat landings, and heliports.

(5) Drawings and plats to clearly illustrate essential parts, including number and location of well slots, water depth, nominal size and thickness of jacket and deck column legs, nominal size, thickness, and design penetration of piling.

(6) A description of the method of corrosion protection.

B. *Environmental Information*

(1) List of pertinent environmental data which have a bearing on the installation, operation, or design of the platform or structure, including wave height, current, wind velocity, water depth, storm and astronomical tide data, and factors considered in subparagraph 1.A.(3).

(2) Listing of total design functional loads and wind, wave, and current forces for the following approaches: longitudinal, transversal, and diagonal.

C. *Foundation*

(1) A listing of on-site investigations and tests, and a basic summary of resultant determinations.

(2) A description of foundation loads for environmental and functional forces listed in subparagraphs 2.B (1) and (2).

(3) In areas susceptible to soil movement, an analysis of slope and soil stability in relation to the foundation design loads.

D. *Installation*. A statement shall be submitted to the effect that the installation recommendations contained in API RP 2A, January 1976, or approved revisions, were adopted; or that significant deviations from the recommendations of API RP 2A were adopted and herewith submitted for approval.

E. *Exception to Supporting Design Information Submittal*. The following information shall be developed and utilized in platform design; however, submittal with the installation application is not required. This information shall be made available to the appropriate District Supervisor upon his request.

(1) A description of the critical design loading and design criteria, taking into consideration maximum environmental and operational loading conditions expected over the service life of the platform or structure. This shall include those conditions considered under subparagraphs 1.A (1), (2), and (3) above.

(2) For steel structures, a description of the materials, specifications, strength analyses, and allowable stresses over the service life.

The recommendations of API publications API RP 2A, "Planning, Designing, and Constructing Fixed Offshore Platforms," January 1976, are acceptable practice concerning subparagraphs (1) and (2) above.

(3) For concrete structures, a description of the materials, specification, and strength and serviceability requirements and analyses of the reinforcing systems.

3. *Certification*

A. Detailed structural plans certified by a registered professional structural engineer shall be on file and maintained by the operator or his designee.

B. The following certifications, signed and dated by a company representative, shall accompany the application:

(1) "(Operator) certifies that this platform has been certified by a registered professional structural engineer and the structure will be constructed, operated, and maintained as described in the application and any approved modification thereto. Certified plans are on file at................."

(2) Certification that the mechanical and electrical systems of the facility will be designed and installed under the supervision of appropriate registered professional engineers. Maintenance of these systems shall be by qualified personnel.

4. *Design, installation, and operational features of production facilities.*

A. All production facilities, including separators, treaters, compressors, headers, and pipelines, shall be designed, installed, and maintained in a manner which will facilitate efficient, safe, and pollution-free operation.

B. As soon as practicable, but not later than six months after the effective date of this Order, new platform production facilities shall be protected with a basic and ancillary surface safety system designed, analyzed, installed, tested, and maintained in operating condition in accordance with the provisions of API RP 14C "Analysis, Design, Installation, and Testing of Basic Surface Safety Systems on

Offshore Production Platforms," June 1974, as amended November 1975, or subsequent revisions as approved by the Area Supervisor, and the additional requirements of this Order. For this application, the word "should" contained in API RP 14C shall be read "shall" except for those contained in explanatory statements, paragraphs 3.4(c), page 11 and 4.3(4) (a)-(f), pages 19-20. In the event that processing components are to be utilized other than those for which Safety Analysis Tables (SAT's) and Safety Analysis Checklists (SAC's) are included in API RP 14C, the analysis technique and documentation specified therein shall be utilized to determine the effects and requirements of such components upon the safety system.

Operators may utilize the options contained in API RP 14C during Safety Systems Design; however, options selected and depicted on the schematic flow diagram and Safety Analysis Function Evaluation (SAFE) Chart are subject to approval by the appropriate District Supervisor.

C. Prior to installation, the operator shall submit for approval to the appropriate District Supervisor, in duplicate, information relative to design and installation features, as indicated in subparagraphs (1) through (6) below. This information shall also be maintained at the operator's onshore field engineering office.

(1) A flow schematic showing size, capacity, and design working pressure of separators, treaters, storage tanks, compressors, pipeline pumps, and metering devices.

(2) A schematic flow diagram (Reference API RP 14C, Example Figure E1, page 79) and the related Safety Analysis Function Evaluation (SAFE) Chart (Reference API RP 14C, paragraph 4.3(C), page 20). These shall be developed with consideration of the provisions of API RP 14C and the additional requirements of this Order.

(3) A schematic piping diagram showing the size and design working pressure with reference to welding specification(s) or code(s) used. The recommendations contained in API RP 14E, "Design and Installation of Offshore Production Platform Piping Systems" are acceptable for platform piping systems.

(4) A diagram of the fire-fighting system.

(5) Electrical system information including the following:

(a) Plan view of each platform deck outlinging any nonrestricted area; i.e., areas which are unclassified with respect to electrical equipment installations, and areas in which potential ignition sources, other than electrical, are to be installed. The area outline should include the following information:

(i) Any surrounding production or other hydrocarbon source and a description of deck, overhead, and firewall.

(ii) Location of generators, control rooms, panel boards, major cabling-conduit routes and identification of wiring method.

(b) Elementary electrical schematic of any platform safety-shutdown system with functional legend.

(6) An application for the installation and maintenance of all gas detection systems. The application shall include the following:

(a) Type, location, and number of detection heads.

(b) Type and kind of alarm, including emergency equipment to be activated.

(c) Method used for detection of combustible gases.

(d) Method and frequency of calibration.

(e) Name of organization to perform system inspection and calibration.

(f) A functional block diagram of the gas detection system, including the electric power supply.

(g) Other pertinent information.

D. *Additional safety and pollution control requirements.* The following requirements modify, or are in addition to, those contained in API RP 14C. For platforms installed after the effective date of this Order, compliance is required as soon as practicable, but not later than six months after the effective date. Operators of facilities installed prior to the effective date of this Order shall comply with these requirements at the earliest practicable date, but not later than one year from the effective date, unless otherwise specified herein.

(1) Design and installation.

(a) Pressure vessels

(i) Pressure relief valves shall be designed, installed, and maintained in accordance with applicable provisions of Sections I, IV, and VIII of the ASME Boiler and Pressure Vessel Code, July 1, 1974. All relief valves and vents shall be piped in such a way as to minimize the possibility of fluid striking personnel or ignition sources.

(ii) Steam generators shall be equipped with low-water-level controls in accordance with applicable provisions of Sections I and IV of the ASME Boiler and Pressure Vessel Code, July 1, 1974.

(iii) All relief valves shall conform to the appropriate sizing and relieving requirements of ASME Boiler and Pressure Vessel Codes, July 1, 1974, Sections I, IV, and VIII. The high-pressure shut-in sensor shall activate sufficiently below the design working pressure to positively insure operation before the relief valve starts relieving. The low-pressure shut-in sensor shall activate no lower than 15 percent or 35 kilopascals (k Pa) (5 psi), whichever is greater below the lowest pressure in the operating range.

(iv) Pressure sensors may be of the automatic or nonautomatic reset type, but where the automatic reset types are used, a nonautomatic reset relay shall be installed. All pressure sensors shall be equipped to permit testing with an external pressure source.

(v) All pressure or fired vessels used in the production of oil or gas, installed after the effective date of this Order, shall conform to the requirements stipulated in the edition of the ASME Boiler and Pressure Vessel Code, Sections I, IV, and VIII, as appropriate, in effect at the time the vessel is installed. Uncoded vessels now in use shall have been hydrostatically tested to a pressure 1.5 times their working pressure. The test date, test pressure, and working pressure shall, within six months after the effective date of this Order, be marked on the vessel in a prominent place. A record of the test shall be maintained by the operator.

(b) Flowlines.

(i) All flowlines from wells shall be equipped with high- and low-pressure shut-in sensors located downstream of the well choke. If there are more than 3 meters (10 feet) of line between the wellhead wing valve and the primary choke, an additional low-pressure shut-in sensor shall be installed in this section. The high-pressure shut-in sensor shall be set no higher than 10 percent above the highest operating pressure of the line, but in all cases, it shall be set sufficiently below the maximum shut-in pressure of the well or the gas-lite supply pressure to assure actuation of the surface safety valve. The low-pressure shut-in sensor shall be set no lower than 10 percent or 35 k Pa (5 psi) whichever is greater, below the lowest operating pressure of the line in which it is installed.

(ii) In the event a well flows directly to the pipeline before separation, the flowing and valves from the well located upstream of, and including, the header inlet valve(s), shall be able to withstand the maximum shut-in pressure of the well, unless 1: protected by a relief valve connected to either the platform flare scrubber or some other approved location other than into the departing pipeline, or 2: the flowline is equipped with an additional automatic shut-down valve controlled by an independent high-pressure sensor. The platform flare scrubber shall be designed to handle, without liquid hydrocarbon carryover to flare, the maximum anticipated flow of liquid hydrocarbons which may be relieved to the vessel.

(c) Remote shut-in systems.

(i) Remote shut-in controls shall be quick-opening valves, except those on the boat landing(s), which may be a plastic loop of the control pressure line.

(d) Engine exhausts.

(i) Engine exhausts shall be equipped to comply with the insulation and personnel protection requirements of API RP 14C, Section 4.2.c.(4). Exhaust piping from diesel engines shall be equipped with spark arrestors.

(e) Glycol dehydration units.

(i) A pressure relief valve shall be installed on the glycol reboiler, or at a location approved by the District Supervisor, which will prevent overpressurization of all glycol dehydration units. The set pressure of this valve shall be determined by the operator and approved by the District Supervisor. The discharge of the relief valve must be vented in a non-hazardous manner.

(f) Compressors.

(i) Each compressor installation existing as of the effective date of this Order shall be protected by high-liquid-level shut-in controls and a pressure relief valve on each interstage scrubber. High-temperature shutdown controls shall be installed on the compressor cylinders unless inter-scrubbers are protected by high- and low-pressure shut-in controls. Compliance is required as soon as practical, but no later than six months after the effective date of this Order.

All compressor installations installed after the effective date of this Order shall be protected by high- and low-pressure and high-liquid-level shut-in controls and a pressure relief valve on each interstage scrubber.

All compressor interstage scrubbers shall be protected by low-liquid-level shut-in controls unless dump is through a choke restriction to another pressure vessel.

(ii) In addition to the provisions of API RP 14C, paragraphs A8.3a and A8.3d, high- and low-pressure shut-in sensors and low-liquid-level shut-in controls protecting compressor suction and discharge piping and associated suction and interstage scrubbers shall be designed to actuate automatic isolation valves located in each compressor suction and fuel gas line so that the compressor unit and associated vessels can be isolated from all input sources.

As an alternative, low-liquid-level shut-in control(s) installed in suction and interstage scrubber(s) may be designed to actuate automatic shutoff valve(s) installed in the scrubber dump line(s).

For compressors installed after the effective date of this Order, those compressor units installed in a building shall have the isolation valves located outside the building. Each suction and interstage high-liquid-level shut-in control shall, as a minimum, be designed to shut down the compressor prime mover.

(iii) Compressor installations of 745 kilowatts (1,000 horsepower) or less are excluded from those requirements of API RP 14C, A8.3d, page 54, which provide for installation of a blowdown valve on the discharge line.

(iv) Compressor installations existing prior to the effective date of this Order, and which are installed in a building, are excluded from the requirement of API RP 14C, A8.3b, Flow Safety Devices (FSV), and Section A.8.3.d., Shutdown Devices (SDV), which prescribes that these devices be located outside of the building.

(v) The automatic isolation valves installed in compressor suction and fuel gas piping shall also be actuated by shutdown of the prime mover.

(g) Curbs, gutters and drains

(i) Curbs, gutters, and drains shall be installed in all deck areas in a manner necessary to collect all contaminants, unless drip pans or equivalent are placed under equipment and piped to a sump which will automatically maintain the oil at a level sufficient to prevent discharge of oil into Gulf waters. Sump piles shall not be used as a processing device to treat or skim liquids but shall be used to collect treated produced water, treated sand, liquids from drip pans and deck drains, and as a final trap for hydrocarbon liquids in event of equipment upsets.

(h) Fire-fighting systems.

(i) A fire-fighting water system of rigid pipe with fire hose stations shall be installed and may include a fixed water-spray system. Such a system shall be installed in a manner necessary to provide, needed protection in areas where production-handling equipment is located. A fire-fighting system using chemicals may be used in lieu of a water system if determined to provide equivalent fire protection control.

An alternate fuel or power source shall be installed to provide continued pump operation for the system during platform shut-down, unless an alternate fire-fighting system is provided.

Portable fire extinguishers shall be located in the living quarters and other strategic areas.

A diagram of the fire-fighting system showing the location of all equipment shall be posted in a prominent place on the platform or structure.

(i) Gas detection system

(i) A diagram of the gas detection system showing the location of all gas detection points shall be posted in a prominent place on the platform or structure.

(ii) All gas detection systems shall be capable of continuously monitoring for the presence of combustible gas in the areas in which the detection devices are located. The gas detector power supply shall be from a continually energized power source.

(iii) The use of fuel gas odorant is an acceptable alternate to an automatic gas detection and alarm system in enclosed, continuously manned areas of the facility.

(j) Electrical equipment. The following requirements shall be applicable to all electrical equipment and systems installed:

(i) All engines with ignition systems shall be equipped with a low-tension ignition system of a low-fire-hazard type and shall be designed and maintained to minimize release of sufficient electrical energy to cause ignition of an external, combustible mixture.

(ii) All electrical generators, motors, and lighting systems shall be installed, protected, and maintained in accordance with the edition of the National Electrical Code and API RP 500 B in effect at the time of installation.

(iii) Wiring methods which conform to the National Electrical Code or to IEEE 45, "Recommended Practice for Electric Installations on Shipboard," in effect at the time of installation, are acceptable.

(iv) An auxiliary power supply shall be installed to provide emergency power capable of operating all electrical equipment required to maintain safety of operations in the event of a failure in the primary electrical power supply.

(k) Erosion. A program of erosion control shall be in effect for wells having a history of sand production. The erosion control program may include sand probes, X-ray, ultrasonic, or other satisfactory monitoring methods. An annual report, by lease, on the results of the program shall be submitted by the first of September to the appropriate District Supervisor.

(2) Operations

(a) Any device on wells, vessels, or flowlines temporarily out of service shall be flagged. Safety devices and systems on wells which are capable of producing shall not be bypassed or blocked out of service unless necessary during startup or maintenance operations and then only with personnel on duty aboard the platform.

(b) When wells are disconnected from producing facilities and blind flanged or equipped with a tubing plug, compliance is not required with provisions of API RP 14C and of this Order concerning (a) installation of high- and low-pressure shut-in sensors downstream of the well choke in flow-lines from wells, and (c) installation of check valves in header individual flowlines.

All open-ended lines connected to producing facilities shall be plugged or blind-flanged, except those lines designed to be open-ended, such as flare or vent lines.

(c) Simultaneous operations. Prior to conducting activities, simultaneously with production operations, which could increase the possibility of occurrences of undesirable events such as harm to personnel or to the environment, or damage to equipment, an operator's Contingency Plan shall be filed for approval with the appropriate District Supervisor. The plan shall be filed within 90 days after the effective date of this Order. A plan shall be submitted by each lessee/operator for each platform existing as of the effective date of this Order. The plan shall be modified and updated as appropriate. Activities requiring the plan are drilling, workover, wireline, and major construction operations. The plan shall include:

(i) A narrative description of operations.

(ii) A plan view of each platform deck indicating critical areas of simultaneous activities.

(iii) Procedures for mitigation of potential undesirable events including:

(a) The guidelines the operator will follow to assure coordination and control of simultaneous activities.

(b) Indication as to the person having overall responsibility, as person in charge at the site, for safety of platform operations.

(c) An outline of any additional safety measures that are required for simultaneous operations.

(d) Specification of any added or special equipment or procedural conditions imposed when simultaneous activities are in progress.

(d) Welding practices and procedures. The following requirements shall apply to all platforms and structures, including mobile drilling and workover structures. These requirements shall apply to fixed structures after the drilling out of the drive or structural casing for the first well drilled on the structure, entry into a well to be tied back to the structure, or first flow of combustible fluids to the structure. The period of time during which these requirements are considered applicable to mobile drilling structures is the interval from the drilling out of the drive or structural casing until the blowout-preventer stack and riser are pulled in the final abandonment. suspension, or completion. These requirements shall apply to workover rigs when such rigs are performing remedial work on any wells open to hydrocarbon-bearing zones.

For the purpose of this Order, the term "welding and burning" is defined to include arc or acetylene cutting and arc or acetylene welding.

Each operator shall file for approval by the appropriate District Supervisor a Welding and Burning Safe Practices and Procedures Plan. The plan shall be filed within 90 days after the effective date of this Order and shall include company qualification standards or requirements for personnel and the methods by which the operator will assure that only personnel meeting such standards or requirements are utilized. A copy of this plan shall be available in the field. Any person designated as a welding supervisor shall be thoroughly familiar with this plan.

Prior to welding or burning operations the operator shall establish approved safe welding areas. Such areas shall be constructed to noncombustible or fire-resistant materials free of combustible or flammable contents and be suitably segregated from adjacent areas. National Fire Protection Association Bulletin No. 51B, "Cutting and Welding Processes," 1971, shall be used as a guide to designate these areas. All welding which cannot be done in the approved safe welding area shall be performed in compliance with the procedures outlined below:

(i) Such welding and burning as are necessary on a structure shall adhere to the following practices:

(a) Prior to the commencement of any welding or burning operations on a structure, the operator's designated person-in-charge at the installation shall personally inspect the qualifications of the welder or welders to assure that they are properly qualified in accordance with the approved company qualification standards or requirements for welders. The designated person-in-charge and welders shall personally inspect the area in which the work is to be performed for potential fire and explosion hazards. After it has been determined that it is safe to proceed with the welding or burning operation, the designated person-in-charge shall issue a written authorization for the work.

(b) All welding equipment shall be inspected prior to beginning any welding or burning. Welding machines located on production or process platforms shall be equipped with spark arrestors and drip pans. Welding leads shall be completely insulated and in good condition; oxygen and acetylene bottles secured in a safe place; and hoses leak free and equipped with proper fittings, gauges, and regulators.

(c) During all welding and burning operations, one or more persons as necessary shall be designated as a Fire Watch. Persons assigned as a Fire Watch shall have no other duties while actual welding or burning operations are in progress.

(d) Prior to any welding or burning, the Fire Watch shall have in his possession fire-fighting equipment in a condition ready to use.

(e) No welding shall be done on containers, tanks, or other vessels which have contained a flammable substance unless the contents of the vessels have been rendered inert and determined to be safe for welding or burning by the designated person-in-charge.

(f) In the event drilling, workover, or wireline operations are in progress on the platform, welding operations in other than approved safe welding areas may be conducted only if the well(s) on which work is being done contain noncumbustible fluids, and entry of formation hydrocarbons into the wellbore is precluded by a positive overbalance toward the formation. Also, all other provisions of this section shall be applicable.

(g) All other producible wells shall be shut-in at the surface safety valves while welding or burning in the wellhead or production area.

(3) Safety device testing. The safety system devices required by this Order shall be tested by the operator at the interval specified below or more frequently if operating conditions warrant. Records shall be maintained at the field office for a period of one year, showing the present status and history of each device, including dates and details of inspection, testing, repairing, adjustment, and reinstallation. Such records shall be available to any authorized representative of the Geological Survey. Records shall be analyzed, equipment or system problem areas identified, and action taken to preclude recurrence of these problems.

Testing and reporting shall be accomplished in accordance with API RP 14C, Appendix D, and the following:

(a) All pressure relief valves shall be tested for operation annually. Pressure relief valves shall be either bench-tested or equipped to permit testing with an external pressure source.

(b) All pressure sensors shall be tested at least once each calendar month, but at no time shall more than six weeks elapse between tests.

(c) All automatic wellhead safety devices and check valves on all flowlines shall be checked for operation and holding pressure once each calendar month, but at no time shall more than six weeks elapse between tests. If any wellhead safety valve indicates leakage, it shall be repaired or replaced.

(d) All liquid-level shut-in controls shall be tested at least once within each calendar month, but at no time shall more than six weeks elapse between tests. These tests shall be conducted by raising or lowering the liquid level across the level-control detector.

(e) All automatic inlet shutoff valves actuated by a sensor on a vessel or a compressor shall be tested for operation at least once within each calendar month, but at no time shall more than six weeks elapse between tests.

(f) All automatic shutoff valves located in liquid discharge lines and actuated by vessel low-level sensors shall be tested for operation once within each calendar month, but at no time shall more than six weeks elapse between tests.

(g) The high-temperature shutdown controls installed in all compressors which are protected against abnormal pressures solely by such temperature safety devices shall be tested annually and repaired or replaced as necessary.

(h) All pumps for fire-fighting water systems shall be inspected and test-operated weekly. A record of the tests shall be maintained at the field office for a period of one year.

(i) The Automatic Gas Detection System shall be tested for operation and recalibrated every six months.

(4) Training. Not later than two years after the effective date of this Order, the operator shall ensure that all personnel engaged in installing, inspecting, testing, and routinely maintaining these safety devices will have been qualified under a program as recommended by API RP T-2, September 1974, amended October 1975, or subsequent revisions approved by the Area Supervisor, or an equivalent program, approved by the Area Supervisor. Documented evidence of qualification of individuals performing these functions shall be maintained at the field headquarters and shall be available to any authorized representative of the Geological Survey.

Manufacturers' representatives may work on component equipment supplied by their company, provided they are directly supervised by a qualified person capable of evaluating the impact of the work on the total system. On-the-job trainees working with safety devices shall be directly supervised by a qualified person.

Not later than one year after the effective date of this Order, the operator shall submit for approval, of the appropriate Area Supervisor, a description of the training to be conducted and the methods the operator will utilize to ensure that only persons qualified as above perform these functions. The description shall include:

(a) The operator's organizational element responsible for training and to interface with the Geological Survey in training program matters.

(b) Categories of personnel to be qualified.

(c) Training organizations and courses to be utilized.

(d) Method for ensuring qualification of third-party personnel if utilized.

(e) Method for determining when additional training or requalification is required and for obtaining same.

(f) Method of monitoring operations to ensure that only qualified personnel perform functions.

(g) Method of maintaining documented evidence of qualification at work site.

5. *Crane operations.* Cranes shall be operated and maintained in a manner necessary to ensure the safety of facility operations in accordance with the provisions of API RP 2D, "Operation and Maintenance of Offshore Cranes," October 1972, or other revisions approved by the Area Supervisor.

Records of inspection, testing, and maintenance shall be kept in the field office for a period of one year. API Specification 2C, "Specification for Offshore Cranes," February 1972, or other revisions approved by the Area Supervisor, shall be used as a guideline for the selection of cranes to be used offshore.

6. *Employee orientation and motivation programs for personnel working offshore.*

The operator shall make a planned, continuing effort to eliminate accidents due to human error. This effort shall include the training of personnel in operational aspects of their functions and a program to instill in each individual working offshore a conscious desire to achieve safe and pollution-free operations. Minimum training of personnel going offshore for the first time shall include an orientation in accordance with API RP T-1, "Orientation Program for Personnel Going Offshore the First Time," January 1974, or equivalent. API Bulletin T-5, "Employee Motivation Programs for Safety and Prevention of Pollution in Offshore Operations," September 1974, shall be used as a guide in developing employee safety and pollution-prevention motivation programs. The applicability of any future revisions of the above API documents shall require approval by the Area Supervisor.

7. *Requirements for drilling rigs*. The requirements of subparagraphs 4.D.(1)(g), 4.D.(1)(j), 4.D.(2)(d), and paragraphs 5 and 6 above shall apply to all drilling rigs and mobile drilling units used to conduct drilling or workover operations on the Federal OCS in the Gulf of Mexico.

/s/ D. W. SOLANAS
Oil and Gas Supervisor
Field Operations
Gulf of Mexico Area

APPROVED:

/s/ RUSSELL G. WAYLAND
Acting Chief
Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 9

Effective October 30, 1970

OIL AND GAS PIPELINES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.19(b). Section 250.19(b) provides as follows:

(b) The Supervisor is authorized to approve the design, other features, and plan of installation of all pipelines for which a right of use or easement has been granted under Paragraph (c) of Section 250.18 or authorized under any lease issued or maintained under the Act, including those portions of such lines which extend onto or traverse areas other than the Outer Continental Shelf.

The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *General Design.* All pipelines shall be designed and maintained in accordance with the following:

A. The operator shall be responsible for the installation of the following control devices on all oil and gas pipelines connected to a platform including pipelines which are not operated or owned by the operator. Operators of platforms installed prior to the effective date of this Order shall comply with the requirements of subparagraphs (1) and (2) within six months of the effective date of this Order. The operator shall submit records semi-annually showing the present status and past history of each device, including dates and details of inspection, testing, repairing, adjustment, and reinstallation.

(1) All oil and gas pipelines leaving a platform receiving production from the platform shall be equipped with a high-low pressure sensor to directly or indirectly shut-in the wells on the platform.

(2) (a) All oil and gas pipelines delivering production to production facilities on a platform shall be equipped with an automatic shut-in valve connected to the platform's automatic and remote shut-in system.

(b) All oil and gas pipelines coming onto a platform shall be equipped with a check valve to avoid backflow.

(c) Any oil or gas pipelines crossing a platform which do not deliver production to the platform, but which may or may not receive production from the platform, shall be equipped with high-low pressure sensors to activate an automatic shut-in valve to be located in the upstream portion of the pipeline at the platform. This automatic shut-in valve shall be connected to either the platform automatic and remote shut-in system or to an independent remote shut-in system.

(d) All pipeline pumps shall be equipped with high-low pressure shut-in devices.

B. All pipelines shall be protected from loss of metal by corrosion that would endanger the strength and safety of the lines either by providing extra metal for corrosion allowance, or by some means of preventing loss of metal such as protective coatings or cathodic protection.

C. All pipelines shall be installed and maintained to be compatible with trawling operations and other uses.

D. All pipelines shall be hydrostatically tested to 1.25 times the designed working pressure for a minimum of 2 hours prior to placing the line in service.

E. All pipelines shall be maintained in good operating condition at all times and inspected monthly for indication of leakage using aircraft, floating equipment, or other methods. Records of these inspections including the date, methods, and results of each inspection shall be maintained by the pipeline operator and submitted annually by April 1. The pipeline operator shall submit records indicating the cause, effect, and remedial action taken regarding all pipeline leaks within one week following each such occurrence.

F. All pipelines shall be designed to be protected against water currents, storm scouring, soft bottoms, and other environmental factors.

2. *Application.* The operator shall submit in duplicate the following to the Supervisor for approval:

A. Drawing on 8″ × 10½″ plat or plats showing the major features and other pertinent data including: (1) water depth, (2) route, (3) location, (4) length, (5) connecting facilities, (6) size, and (7), burial depth, if buried.

B. A schematic drawing showing the following pipeline safety equipment and the manner in which the equipment functions: (1) high-low pressure sensors, (2) automatic shut-in valves, and (3) check valves.

C. General information concerning the pipeline including the following:

(1) Product or products to be transported by the pipeline.

(2) Size, weight, and grade of the pipe.

(3) Length of line.

(4) Maximum water depth.

(5) Type or types of corrosion protection.

(6) Description of protective coating.

(7) Bulk specific gravity of line (with the line empty).

(8) Anticipated gravity or density of the product or products.

(9) Design working pressure and capacity.

(10) Maximum working pressure and capacity.

(11) Hydrostatic pressure and hold time to which the line will be tested after installation.

(12) Size and location of pumps and prime movers.

(13) Any other pertinent information as the Supervisor may prescribe.

3. *Completion Report.* The operator shall notify the Supervisor when installation of the pipeline is completed and submit a drawing on 8″ × 10″ plats showing the location of the line as installed, accompanied by all hydrostatic test data including procedure, test pressure, hold time, and results.

/s/ Robert F. Evans
Supervisor

Approved: October 30, 1970

/s/ Russell G. Wayland
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 10
Effective August 28, 1969

SULPHUR DRILLING PROCEDURES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.34, 250.41, and 250.91. All exploratory core holes for sulphur and all sulphur development wells shall be drilled in accordance with the provisions of this Order, except that development wells shall be drilled in accordance with field rules when established by the supervisor. Each Application to Drill (Form 9–331C) shall include all information required under 30 CFR 250.91 and the integrated casing, cementing, mud, and blowout prevention program for the well. The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Well Casing and Cementing.* All wells shall be cased and cemented in accordance with the requirements of 30 CFR 250.41(a)(1). Special consideration to casing design shall be given to compensate for effects caused by subsidence, corrosion, and temperature variation. All depths refer to true vertical depth (TVD).

A. *Drive or Structural Casing.* This casing shall be set by drilling, driving, or jetting to a minimum depth of 100 feet below the Gulf floor, or to such greater depth required to support unconsolidated deposits and to provide hole stability for initial drilling operations. If drilled in, the drilling fluid shall be a type that will not pollute the Gulf, and a quantity of cement sufficient to fill the annular space back to the Gulf floor must be used.

B. *Conductor Casing.* This casing shall be set and cemented before drilling into shallow formations known to contain hydrocarbons or, if unknown, upon encountering such formations. Conductor casing shall extend to a depth of not less than 350 feet nor more than 750 feet below the Gulf floor. A quantity of cement sufficient to fill the annular space back to the Gulf floor must be used. The cement may be washed out or displaced to a depth of 40 feet below the Gulf floor to facilitate casing removal upon well abandonment.

C. *Caprock Casing.* This casing shall be set at the top of the caprock and be cemented with a quantity of cement sufficient to fill the annular space back to the Gulf floor. Stage cementing or other cementing method shall be used to insure cement returns to the Gulf floor.

2. *Blowout Prevention Equipment.* Blowout preventers and related well control equipment shall be installed, used, and tested in a manner necessary to prevent blowouts. Prior to drilling below the conductor casing, blowout prevention equipment shall be installed and maintained ready for use until drilling operations are completed, as follows:

A. *Conductor Casing.* Before drilling below this string, at least one remotely controlled bag-type blowout preventer and equipment for circulating the drilling fluid to the drilling structure or vessel shall be installed. To avoid formation fracturing from complete shut-in of the well, a large diameter pipe with control valves shall be installed on the conductor casing below the blowout preventer so as to permit the diversion of hydrocarbons and other fluids; except that when the blowout preventer assembly is on the Gulf floor, the choke and kill lines shall be equipped to permit the diversion of hydrocarbons and other fluids.

B. *Caprock Casing.* Before drilling below this string, the blowout prevention equipment shall include a minimum of: (1) three remotely controlled, hydraulically operated, blowout preventers with a working pressure which exceeds the maximum anticipated surface pressure, including one equipped with pipe rams, one with blind rams, and one bag-type; (2) a drilling spool with side outlets, if side outlets are not provided in the blowout preventer body; (3) a choke manifold; (4) a kill line; and (5) a fill-up line.

C. *Testing*. Ram-type blowout preventers and related control equipment shall be tested with water to the rated working pressure of the stack assembly, or to the working pressure of the casing, whichever is the lesser, (1) when installed; (2) before drilling out after each string of casing is set; (3) not less than once each week while drilling; and (4) following repairs that require disconnecting a pressure seal in the assembly. The bag-type blowout preventer shall be tested to 70 percent of the above pressure requirements.

While drill pipe is in use ram-type blowout preventers shall be actuated to test proper functioning once each day. The bag-type blowout preventer shall be actuated on the drill pipe once each week. Accumulators or accumulators and pumps shall maintain a pressure capacity reserve at all times to provide for repeated operation of hydraulic preventers. A blowout prevention drill shall be conducted weekly for each drilling crew to insure that all equipment is operational and that crews are properly trained to carry out emergency duties. All blowout preventer tests and crew drills shall be recorded on the driller's log.

D. *Other Equipment*. A drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. Separate valves shall be maintained on the rig floor to fit all pipe in the drill string. A Kelly cock shall be installed below the swivel.

3. *Mud Program—General*. The characteristics, use, and testing of drilling mud and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Quantities of mud materials sufficient to insure well control shall be maintained readily accessible for use at all times. The following mud control and testing equipment requirements are applicable to operations conducted prior to drilling below the caprock casing.

A. *Mud Control*. Before starting out of the hole with drill pipe, the mud shall be circulated with the drill pipe just off bottom until the mud is properly conditioned. When coming out of the hole with drill pipe, the annulus shall be filled with mud before the mud level drops below 100 feet, and a mechanical device for measuring the amount of mud required to fill the hole shall be utilized. The volume of mud required to fill the hole shall be watched, and any time there is an indication of swabbing, or influx of formation fluids, the drill pipe shall be run to bottom, and the mud properly conditioned. The mud shall not be circulated and conditioned except on or near bottom, unless well conditions prevent running the pipe to bottom.

B. *Mud Testing and Equipment*. Mud testing equipment shall be maintained on the drilling platform at all times, and mud tests shall be performed daily, or more frequently as conditions warrant.

The following mud system monitoring equipment must be installed (with derrick floor indicators) and used throughout the period of drilling after setting and cementing the conductor casing:

(1) Recording mud pit level indicator to determine mud pit volume gains and losses. This indicator shall include a visual or audio warning device.

(2) Mud volume measuring device for accurately determining mud volumes required to fill the hole on trips.

(3) Mud return indicator to determine that returns essentially equal the pump discharge rate.

/s/ Robert F. Evans
Supervisor

Approved: August 28, 1969

/s/ Russell G. Wayland
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVSION

GULF OF MEXICO AREA

OCS ORDER NO. 11

Effective May 1, 1974

OIL AND GAS PRODUCTION RATES, PREVENTION OF WASTE, AND PROTECTION OF CORRELATIVE RIGHTS

This Order is established pursuant to the authority prescribed in 30 CFR 250.1, 30 CFR 250.11, and in accordance with all other applicable provisions of 30 CFR Part 250, and the notice appearing in the Federal Register, dated December 5, 1970 (35 F.R. 18559), to provide for the prevention of waste and conservation of the natural resources of the Outer Continental Shelf, and the protection of correlative rights therein. This Order shall be applicable to all oil and gas wells on Federal leases in the Outer Continental Shelf of the Gulf of Mexico; provided, however, that it shall not apply to oil and gas wells on a lease of which any part lies within the disputed area referred to in paragraph 4 of the Supplemental Decree of December 20, 1971, in United States vs. Louisiana, et al., 404 U.S. 388 (1971). All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b). References in this Order to approvals, determinations, and requirements for submittal of information or applications for approval are to those granted, made, or required by the Oil and Gas Supervisor or his delegated representative.

1. *Definition of Terms.* As used in this Order, the following terms shall have the meanings indicated:

A. *Waste of Oil and Gas.* The definition of waste appearing in 30 CFR 250.2(h) shall apply, and includes the failure to timely initiate enhanced recovery operations where such methods would result in an increased ultimate recovery of oil or gas under sound engineering and economic principles. Enhanced recovery operations refers to pressure maintenance operations, secondary and tertiary recovery, cycling, and similar recovery operations which alter the natural forces in a reservoir to increase the ultimate recovery of oil or gas.

B. *Correlative Rights.* The opportunity afforded each lessee or operator to produce without waste his just and equitable share of oil and gas from a common source of supply.

C. *Maximum Efficient Rate (MER).* The maximum sustainable daily oil or gas withdrawal rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to ultimate recovery.

D. *Maximum Production Rate (MPR).* The approved maximum daily rate at which oil may be produced from a specified oil well completion or the maximum approved daily rate at which gas may be produced from a specified gas well completion.

E. *Interested Parts.* The operators and lessees, as defined in 30 CFR 250.2(f) and (g), of the lease or leases involved in any proceeding initiated under this Order.

F. *Reservoir.* An oil or gas accumulation which is separated from and not in oil or gas communication with any other such accumulation.

G. *Competitive Reservoir.* A reservoir as defined herein containing one or more producible or producing well completions on each of two or more leases, or portions thereof, in which the lease or operating interests are not the same.

H. *Property Line.* A boundary dividing leases, or portions thereof, in which the lease or operating interest is not the same. The boundaries of Federally approved unit areas shall be considered property lines. The boundaries dividing leased and unleased acreage shall be considered property lines for the purpose of this Order.

I. *Oil Reservoir.* A reservoir that contains hydrocarbons predominantly in a liquid (single-phase) state.

J. *Oil Well Completion.* A well completed in an oil reservoir or in the oil accumulation of an oil reservoir with an associated gas cap.

K. Gas Reservoir. A reservoir that contains hydrocarbons predominantly in a gaseous (single-phase) state.

L. *Gas Well Completion.* A well completed in a gas reservoir or in the gas cap of an oil reservoir which an associated gas cap.

M. *Oil Reservoir with an Associated Gas Cap.* A reservoir that contains hydrocarbons in both a liquid and a gaseous state (two-phase).

N. *Producible Well Completion.* A well which is physically capable of production and which is shut in at the wellhead or at the surface, but not necessarily connected to production facilities, and from which the operator plans future production.

2. *Classification of Reservoirs.*

A. *Initial Classification.* Each producing reservoir shall be classified by the operator, subject to approval by the Supervisor, as an oil reservoir, an oil reservoir with an associated gas cap, or a gas reservoir.

(1) The initial classification of each reservoir from which production is commenced subsequent to the date of this Order shall be submitted for approval with the initial submittal of MER data for the reservoir.

(2) Each reservoir from which production commenced on or prior to the date of this Order shall be classified by the operator, based on existing reservoir conditions. Such classification shall be determined and submitted to the Supervisor within six (6) months of the date of this Order.

B. *Reclassification.* A reservoir may be reclassified by the Supervisor, on his own initiative or upon application of an operator, during its productive life when information becomes available showing that such reclassification is warranted.

3. *Oil and Gas Production Rates.*

A. *Maximum Efficient Rate (MER).* The operator shall propose a maximum efficient rate (MER) for each producing reservoir based on sound engineering and economic principles. When approved at the proposed or other rate, such rate shall not be exceeded, except as provided in paragraph 4 of this Order.

(1) *Submittal of Initial MER.* Within 45 days after the date of first production or such longer period as may be approved, the operator shall submit a Request for Reservoir MER (Form 9-1866) with appropriate supporting information.

(2) *Revision of MER.* The operator may request a revision of an MER by submitting the proposed revision to the Supervisor on a Request for Reservoir MER (Form 9-1866) with appropriate supporting information. The Operator shall obtain approval to produce at test rates which exceed an approved MER when such testing is necessary to substantiate an increase in the MER.

(3) *Review of MER.* The MER for each reservoir will be reviewed by the operator annually, or at such other required or approved interval of time. The results of the review, with all current supporting information, shall be submitted on a Request for Reservoir MER (Form 9-1866).

(4) *Effective Date of MER.* The effective date of an MER, or revision thereof, will be determined by the Supervisor and shown on a Request for Reservoir MER (Form 9-1866) when the MER is approved. The effective date for an initial MER shall be the first day following the completion of an approved testing period. The effective date for a revised MER shall be the first day following the completion of an approved testing period, or if testing is not conducted, the date the revision is approved.

B. *Maximum Production Rate (MPR).* The operator shall propose a maximum production rate (MPR) for each producing well completion in a reservoir together with full information on the method used in its determination. When an MPR has been approved for a well completion, that rate shall not be exceeded, except as provided in paragraph 4 of this Order. The MPR shall be based on well tests and any limitations imposed by (1) well tubing, safety equipment, artificial lift equipment, surface back pressure, and equipment capacity; (2) sand producing problems; (3) producing gas-oil and water-oil ratios; (4) relative structural position of the well with respect to gas-oil or water-oil contacts; (5) position of perforated interval within total production zone; and (6) prudent operating practices. The MPR established for each well completion shall not exceed 110 percent of the rate demonstrated by a well test unless justified by supporting information.

(1) *Submittal of Initial MPR.* The operator shall have 30 days from the date of first continuous production within which to conduct a potential test, as specified under subparagraphs 5.B and 6.B of this Order, on all new and reworked well completions. Within 15 days after the date of the potential test, the operator shall submit a proposed MPR for the individual well

completion on a Request for Well Maximum Production Rate (MPR) (Form 9-1867), with the results of the potential test on a Well Potential Test Report (Form 9-1868). Extension of the 30-day test period may be granted. The effective date for any approved initial MPR shall be the first day following the test period. During the 30-day period allowed for testing, or any approved extensions thereof, the operator may produce a new or reworked well completion at rates necessary to establish the MPR. The operator shall report the total production obtained during the test period, and approved extensions thereof, on the Well Potential Test Report (Form 9-1868).

(2) *Revision of MPR Increase*. If necessary to test a well completion at rates above the approved MPR to determine whether the MPR should be increased, notification of intent to test the well at such higher rates, not to exceed a stated maximum rate during a specified test period, shall be filed with the Supervisor. Such tests may commence on the day following the date of filing notification, unless otherwise ordered by the Supervisor. If an operator determines that the MPR should be increased, he shall submit, within 15 days after the specified test period, a proposed increased MPR on a Request for Well Maximum Production Rate (MPR) (Form 9-1867), and any other available data to support the requested revision, including the results of the potential test and the total production obtained during the test period on a Well Potential Test Report (Form 9-1868). Prior to approval of the proposed increased MPR, the operator may produce the well completion at a rate not to exceed the proposed increased MPR of the well. The effective date for any approved increased MPR shall be the first day following the test period. If testing rates or increased MPR rates result in production from the reservoir in excess of the approved MER, this excess production shall be balanced by underproduction from the reservoir under the provisions of subparagraph 4.B of this Order.

(3) *Revision of MPR Decrease*. When the quarterly test rate for an oil well completion or the semiannual test rate for a gas well completion required under subparagraphs 5.C and 6.C of this Order is less than 90 percent of the existing approved MPR for the well, a new reduced MPR will be established automatically for that well completion equal to 110 percent of the test rate submitted. The effective date for the new MPR for such well completion shall be the first day of the quarter following the required date of submittal of periodic well-test results under subparagraphs 5.C and 6.C of this Order. Also, the operator may notify the Supervisor on a Request for Well Maximum Production Rate (MPR) (Form 9-1867) of, or the Supervisor may require a downward revision of a well MPR at any time when the well is no longer capable of producing its approved MPR on a sustained basis. The effective date for such reduced MPR for a well completion shall be the first day of the month following the date of notification. (4) *Continuation of MPR*. If submittal of the results of a quarterly well test for an oil completion or a semiannual well test for a gas well completion, as provided for in subparagraphs 5.C and 6.C of this Order, cannot be timely, continuation of production under the last approved MPR for the well may be authorized, provided an extension of time in which to submit the test results is requested and approved in advance.

(5) *Cancellation of MPR*. When a well completion ceases to produce, is shut in pending workover, or any other condition exists which causes the assigned MPR to be no longer appropriate, the operator shall notify the Supervisor accordingly on a Request for Well Maximum Production Rate (MPR) (Form 9-1867), indicating the date of last production from the well, and the MPR will be canceled. Reporting of temporary shut-ins by the operator for well maintenance, safety conditions, or other normal operation conditions is not required, except as is necessary for completion of the Monthly Report of Operations (Form 9-152).

C. *MER and MPR Relationship*. The withdrawal rate from a reservoir shall not exceed the approved MER and may be produced from any combination of well completions subject to any limitations imposed by the MPR established for each well completion. The rate of production from the reservoir shall not exceed the MER although the summation of individual well MPR's may be greater than the MER.

4. *Balancing of Production*.

A. *Production Variances*. Temporary well production rates resulting from normal variations and fluctuations exceeding a well MPR or reservoir MER shall not be considered a violation of this Order, and such production may be sold or transferred pursuant to paragraph 8 of this Order. However, when normal variations and fluctuations result in production in excess of a reservoir MER, any operator who is overproduced shall balance such production in accordance with subparagraph 4.B below. Such operator shall advise the Supervisor of the amount of such excess production from the reservoir for the month at the same time as Form 9-152 is filed for that month.

B. *Balancing Periods.* As of the first day of the month following the month in which this Order becomes effective, all reservoirs shall be considered in balance. Balancing periods for overproduction of a reservoir MER shall end on January 1, April 1, July 1, and October 1 of each year. If a reservoir is produced at a rate in excess of the MER for any month, the operator who is overproduced shall take steps to balance production during the next succeeding month. In any event, all overproduction shall be balanced by the end of the next succeeding quarter following the quarter in which the overproduction occurred. The operator shall notify the Supervisor at the end of the month in which he has balanced the production from an overproduced reservoir.

C. *Shut-in for Overproduction.* Any operator in an overproduction status in any reservoir for two successive quarters which has not been brought into balance within the balancing period shall be shut in from that reservoir until the actual production equals that which would have occurred under the approved MER.

D. *Temporary Shut-in.* If, as a result of storm, hurricanes, emergencies, or other conditions perculiar to offshore operations, an operator is forced to curtail or shut in production from a reservoir, the Supervisor may, on request, approve makeup of all or part of this production loss.

5. *Oil Well Testing Procedures.*

A. *General.* Tests shall be conducted for not less than four consecutive hours. Immediately prior to the 4-hour test period, the well completion shall have produced under stabilized conditions for a period of not less than six consecutive hours. The 6-hour pretest period shall not begin until after recovery of a volume of fluid equivalent to the amount of fluids introduced into the formation for any purpose. Measured gas volumes shall be adjusted to the standard conditions of 15.015 psia and 60°F. for all tests. When orifice meters are used, a specific gravity shall be obtained or estimated for the gas and a specific gravity correction factor applied to the orifice coefficient. The Supervisor may require a prolonged test or retest of a well completion if such test is determined to be necessary for the establishment of a well MPR or a reservoir MER. The Supervisor may approve test periods of less than four hours and pretest stabilization periods of less than six hours for well completions, provided that test reliability can be demonstrated under such procedures.

B. *Potential Test.* Test data to establish or to increase an oil well MPR shall be submitted on a Well Potential Test Report (Form 9-1868). The total production obtained from all tests during the test period shall be reported on such form.

C. *Quarterly Test.* Tests shall be conducted on each producing oil well completion quarterly, and test results shall be submitted on a Quarterly Oil Well Test Report (Form 9-1869). Testing periods and submittal dates shall be as follows:

Testing Period	Latest Date for Submittal of Test Results	For Quarter Beginning
Sept. 11—Dec. 10	Dec. 10	Jan. 1
Dec. 11—Mar. 10	Mar. 10	April 1
Mar. 11—June 10	June 10	July 1
June 11—Sept. 10	Sept. 10	Oct. 1

There shall be a minimum of 45 days between quarterly tests for an oil well completion.

6. *Gas Well Testing Procedures.*

A. *General.* Testing procedures for gas well completions shall be the same as those specified for oil well completions in subparagraph 5.A except for the initial test which shall be a multi-point back-pressure test as described in paragraph 6.D.

B. *Potential Test.* Test data to establish or to increase a gas well MPR shall be submitted on a Well Potential Test Report (Form 9-1868).

C. *Semiannual Test.* Tests shall be conducted on each producing gas well completion semiannually, and test results shall be submitted on a Semiannual Gas Well Test Report (Form 9-1870). Testing periods and submittal dates shall be as follows:

Testing Period	For Submittal of Test Results	For Semi-Annual Period Beginning
June 11—Dec. 10	Dec. 10	Jan. 1
Dec. 11—June 10	June 10	July 1

There shall be a minimum of 90 days between semiannual tests for a gas well completion.

D. *Back-Pressure Tests.* A multi-point back-pressure test to determine the theoretical open-flow potential of gas wells shall be conducted within thirty days after connection to a pipeline. If bottom-hole pressures are not measured, such pressures shall be calculated from surface pressures using the method, or other similar method, found in the Interstate

Oil Compact Commission (IOCC) Manual of Back-Pressure Testing of gas wells. The results of all back-pressure tests conducted by the operator shall be filed with the Supervisor, including all basic data used in determining the test results. The Supervisor may waive this requirement if multi-point back-pressure test information has previously been obtained on a representative number of wells in a reservoir.

7. *Witnessing Well Tests*. The Supervisor may have a representative witness any potential or periodic well tests on oil and gas well completions. Upon request, an operator shall notify the appropriate District office of the time and date of well tests.

8. *Sale or Transfer of Production*. Oil and gas produced pursuant to the provisions of this Order, including test production, may be sold to purchasers or transferred as production authorized for disposal hereunder.

9. *Bottom-Hole Pressure Tests*. Static bottom-hole pressure tests shall be conducted annually on sufficient key wells to establish an average reservoir pressure in each producing reservoir unless a different frequency is approved. The Operator may be required to test specific wells. Results of bottom-hole pressure tests shall be submitted within 60 days after the date of the test.

10. *Flaring and Venting of Gas*. Oil- and gas-well gas shall not be flared or vented, except as provided herein.

A. *Small-Volume of Short-Term Flaring or Venting*. Oil- and gas-well gas may be flared or vented in small volumes or temporarily without the approval of the Supervisor in the following situations:

(1) *Gas Vapors*. When gas vapors are released from storage and other low-pressure production vessels if such gas vapors cannot be economically recovered or retained.

(2) *Emergencies*. During temporary emergency situations, such as compressor or other equipment failure, or the relief of abnormal system pressures.

(3) *Well Purging and Evaluation Tests*. During the unloading or cleaning up of a well and during drillstem, producing, or other well evaluation tests not exceeding a period of 24 hours.

B. *Approval for Routine or Special Well Tests*. Oil- and gas-well gas may be flared or vented during routine and special well tests, other than those described in paragraph A above, only after approval of the Supervisor.

C. *Gas-Well Gas*. Except as provided in A and B above, gas-well gas shall not be flared or vented.

D. *Oil-Well Gas*. Except as provided in A and B above, oil-well gas shall not be flared or vented unless approved by the Supervisor. The Supervisor may approve an application for flaring or venting of oil-well gas for periods not exceeding one year if (1) the operator has initiated positive action which will eliminate flaring or venting, or (2) the operator has submitted an evaluation supported by engineering, geologic, and economic data indicating that rejection of an application to flare or vent the gas will result in an ultimate greater loss or equivalent total energy than could be recovered for beneficial use from the lease if flaring or venting were allowed.

E. *Content of Application*. Applications under paragraph D above for existing operations, as of the date of this Notice, shall be filed within three months from the effective date of this Order. Applications under paragraph D(2) above shall include all appropriate engineering, geologic, and economic data in an evaluation showing that absence of approval to flare or vent the gas will result in premature abandonment of oil and gas production or curtailment of lease development. Applications shall include an estimate of the amount and value of the oil and gas reserves that would not be recovered if the application to flare or vent were rejected and an estimate of the total amount of oil to be recovered and associated gas that would be flared or vented if the application were approved.

11. *Disposition of Gas*. The disposition of all gas produced from each lease shall be reported monthly on, or attached to, Form 9-152. The report shall be submitted in the following manner:

	Oil-Well Gas (MCF)	Gas-Well Gas (MCF)
Sales....................	....	....
Fuel....................	....	....
*Injected..............	....	....
Flared..................	....	....
Vented.................	....	....
Other (Specify)......	....	....
Total..............	....	....

*Gas produced from the lease and injected on or off the lease.

12. *Multiple and Selective Completions*.

A. *Number of Completions*. A well bore may contain any number of producible completions when justified and approved.

B. *Numbering Well Completions*. Well completions made after the date of this Order shall be designated using numerical and alphabetical nomenclature. Once designated as a reservoir completion, the well completion number shall not change. Appendix A contains a detailed explanation of procedures for naming well completions.

C. *Packer Tests.* Multiple and selective completions shall be equipped to isolate the respective producing reservoirs. A packer test or other appropriate reservoir isolation test shall be conducted prior to or immediately after initiating production and annually thereafter on all multiply completed wells. Should the reservoirs in any multiply completed well become intercommunicative the operator shall make repairs and again conduct reservoir isolation tests unless some other operational procedure is approved. The results of all tests shall be submitted on a Packer Test (Form 9-1871) within 30 days after the date of the test.

D. *Selective Completions.* Completion equipment may be installed to permit selective reservoir isolation or exposure in a well bore through wireline or other operations. All selective completions shall be designated in accordance with subparagraph 12.B when the application for approval of such completions is filed.

E. *Commingling.* Commingling of production from two or more separate reservoirs within a common well bore may be permitted if it is determined that, collectively, the ultimate recovery will not be decreased. An application to commingle hydrocarbons from multiple reservoirs within a common well bore shall be submitted for approval and shall include all pertinent well information, geologic and reservoir engineering data, and a schematic diagram of well equipment. For all competitive reservoirs, notice of the application shall be sent by the applicant to all other operators of interest in the reservoirs prior to submitting the application to the Supervisor. The application shall specify the well completion number to be used for subsequent reporting purposes.

13. *Gas-Cap Well Completions.* All existing and future wells completed in the gas cap of a reservoir which has been classified and approved as an associated oil reservoir shall be shut in until such time as the oil is depleted or the reservoir is reclassified as a gas reservoir; provided, however, that production from such wells may be approved when (1) it can be shown that such gas-cap production would not lead to waste of oil and gas, or (2) when necessary to protect correlative rights unless it can be shown that this production will lead to waste of oil and gas.

143. *Location of Wells.*

A. *General.* The location and spacing of all exploratory and development wells shall be in accordance with approved programs and plans required in 30 CFR 250.17 and 250.34. Such location and spacing shall be determined independently for each lease or reservoir in a manner which will locate wells in the optimum structural position for the most effective production of reservoir fluids and to avoid the drilling of unnecessary wells.

B. *Distance from Property Line.* An operator may drill exploratory or development wells at any location on a lease in accordance with approved plans; provided that no well directionally or vertically drilled and completed after the date of this Order in which the completed interval is less than 500 feet from a property line shall be produced unless approved by the Supervisor.

For wells drilled as vertical holes, the surface location of the well shall be considered as the location of the completed interval but shall be subject to the provisions of 30 CFR 250.40(b). An operator requesting approval to produce a directionally drilled well in which the completed interval is located closer than 500 feet from a property line, or approval to produce a vertically drilled well with a surface location closer than 500 feet from a property line, shall furnish the Supervisor with letters expressing acceptance or objection from operators of offset properties.

15. *Enhanced Oil and Gas Recovery Operations.* Operators shall timely initiate enhanced oil and gas recovery operations for all competitive and noncompetitive reservoirs where such operations would result in an increased ultimate recovery of oil or gas under sound engineering and economic principles. A plan for such operations shall be submitted with the results of the annual MER review as required in paragraph 3A(3) of this Order.

16. *Competitive Reservoir Operations.* Development and production operations in a competitive reservoir may be required to be conducted under either pooling and drilling agreements or unitization agreements when the Conservation Manager determines, pursuant to 30 CFR 250.50 and delegated authority, that such agreements are practicable and necessary or advisable and in the interest of conservation.

A. *Competitive Reservoir Determination.* The Supervisor shall notify the operators when he has made a preliminary determination that a reservoir is competitive as defined in this Order. An operator may request at any time that the Supervisor make a preliminary determination as to whether a reservoir is competitive. The operators, within thirty (30) days of such preliminary notification or such extension of time as approved by the Supervisor, shall advise of their concurrence with such determination, or submit objections with supporting evidence. The Supervisor will make a final determination and notify the operators.

B. *Development and Production Plans.* When drilling and/or producing operations are conducted in a competitive reservoir, the operators shall submit for approval a plan governing the applicable operations. The plan shall be submitted within ninety (90) days after a determination by the Supervisor that a reservoir is competitive or within such extended period of time as approved by the Supervisor. The plan shall provide for the development and/or production of the reservoir, and may provide for the submittal of supplemental plans for approval by the Supervisor.

(1) *Development Plan.* When a competitive reservoir is still being developed or future development is contemplated, a development plan may be required in addition to a production plan. This plan shall include the information required in 30 CFR 250.34. If agreement to a joint development plan cannot be reached by the operators, each shall submit a separate plan and any differences may be resolved in accordance with paragraph 17 of the Order.

(2) *Production Plan.* A joint production plan is required for each competitive reservoir. This plan shall include (a) the proposed MER for the reservoir, (b) the proposed MPR for each completion in the reservoir, (c) the percentage allocation of reservoir MER for each lease involved, and (d) plans for secondary recovery or pressure maintenance operations. If agreement to a joint production plan cannot be reached by the operators, each shall submit a separate plan, and any differences may be resolved in accordance with paragraph 17 of this Order.

C. *Utilization.* The Conservation Manager shall determine when conservation will be best served by unitization of a competitive reservoir, or any reservoir reasonable delineated and determined to be productive, in lieu of a development and/or production plan or when the operators and lessees involved have been unable to voluntarily effect unitization. In such cases, the Conservation Manager may require that development and/or production operations be conducted under an approved unitization plan. Within six (6) months after notification by the Conservation Manager that such a unit plan is required, or within such extended period of time as approved by the Conservation Manager, the lessees and operators shall submit a proposed unit plan for designation of the unit area and approval of the form of agreement pursuant to 30 CFR 250.51.

17. *Conferences, Decisions and Appeals.* Conferences with interested parties may be held to discuss matters relating to applications and statements of position filed by the parties relating to operations conducted pursuant to this Order. The Supervisor or Conservation Manager may call a conference with one or more, or all, interested parties on his own initiative or at the request of any interested party. All interested parties shall be served with copies of the Supervisor's or Conservation Manager's decisions. Any interested party may appeal decisions of the Supervisor or Conservation Manager pursuant to 30 CFR 250.8l. Decisions of the Supervisor or Conservation Manager shall remain in effect and shall not be suspended by reason of any appeal, except as provided in that regulation.

/s/ J. B. LOWENHAUPT
Oil and Gas Supervisor
Production Control
Gulf of Mexico Area

APPROVED: MAY 1, 1974

/s/ RUSSELL G. WAYLAND
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 11
APPENDIX A

Subparagraph 12.B.: "Numbering Well Completions. Well completions made after the date of this Order shall be designated using numerical and alphabetical nomenclature. Once designated as a reservoir completion, the well completion number shall not change..."

The intent of this subparagraph is not necessarily to change the existing well completion names but to change the method of naming well completions after the effective date of this Order in order to insure that a completion in a given reservoir and a specific well bore will be assigned a unique name and will retain that name permanently. For further clarification, the following guidelines and examples are offered:

1. Each well bore will have a distinct, permanent number.
2. Each reservoir completion in a well bore will have a unique permanent designation which includes the well bore number in its nomenclature.
3. For the purpose of this subparagraph, a "completion" is defined as all perforations in a given reservoir in a specific well bore and is not necessarily associated with a tubing string or strings.
4. If more than one completion is made in a well bore, an alphabetical suffix must be used in the nomenclature to differentiate between completions.
5. An alphabetical prefix may be utilized to designate the platform from which the well will be produced.

Example No. 1: The first well drilled from the A platform is a single completion.

Well No. A-1

(Should an operator wish to use an alphabetical suffix with a single completion, he may do so.)

Example No. 2: A well drilled by a mobile rig need not carry an alphabetical prefix.

Well No. 1

(If the well is later connected to and produced from a production platform, the well shall be redesignated to reflect an alphabetical prefix.)

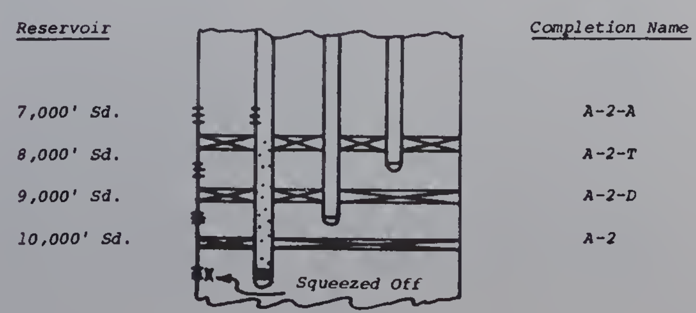
Example No. 3: The second well drilled from the A Platform is a triple completion.

First Completion	Second Completion	Third Completion
A-2	A-2-D	A-2-T

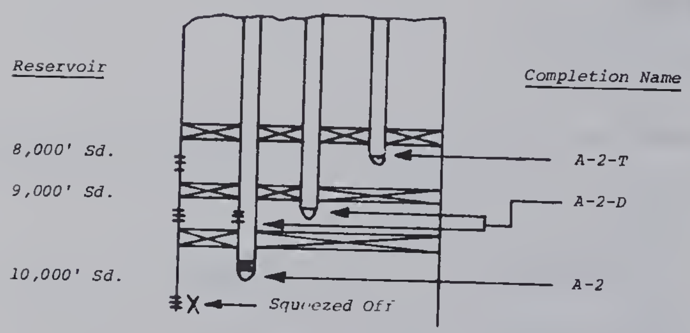
(In the above example, the letters "D" and "T" were used in naming the second and third completions utilizing current industry practice, although the intent is not to restrict operators to the use of these particular alphabetical suffixes. Any alphabetical suffix may be used as long as it is unique to the completion in that reservoir.)

Example No. 4: The drawing is shown to illustrate the fact that once a completion in a specific well bore is designated in a given reservoir, it will retain that name permanently. Let us consider the A-2 completion shown in Example No. 3. Should a recompletion be made in a different reservoir at a later date, it shall be renamed; however, the production from the reservoir associated with the original A-2 completion will always be identified with the A-2 completion. Once the A-2 completion in the 10,000′ sand is squeezed and plugged off and the recompletion made to the 7,000′ sand, the completion in the 7,000′ sand would be designated A-2-A (or some other alphabetical suffix other than the "D" or "T" presently associated with other completions in the 9,000′ and 8,000′ sands).

The Sundry Notices and Reports on Wells (Form 9-331) submitted to obtain approval for the workover shall be the vehicle for naming the new completion.



Example No. 5: If the A-2 completion in Example No. 4 had been recompleted from the 10,000′ sand to the 9,000′ sand (where the A-2-D is currently completed), the completion would still be named A-2-D as both tubing strings would be considered one completion for purposes of this Order.



UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 12

Effective February 1, 1975

PUBLIC INSPECTION OF RECORDS

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.97 and 43 CFR 2.2, and supersedes OCS Order No. 12, dated August 13, 1971. Section 250.97 of 30 CFR provides as follows:

Public Inspection of Records. Geological and geophysical interpretations, maps, and data required to be submitted under this part shall not be available for public inspection without the consent of the lessee so long as the lease remains in effect or until such time as the supervisor determines that release of such information is required and necessary for the proper development of the field or area.

Section 2.2 of 43 CFR provides in part as follows:

Determinations as to Availability of Records. (a) Section 552 of Title 5, U.S. Code, as amended by Public Law 90-23 (the act codifying the "Public Information Act") requires that identifiable agency records be made available for inspection. Subsection (b)[1] of section 552 exempts several categories of records from the general requirement but does not require the withholding from inspection of all records which may fall within the categories exempted. Accordingly, no request made of a field office to inspect a record shall be denied unless the head of the office or such higher field authority as the head of the bureau may designate shall determine (1) that the record falls within one or more of the categories exempted and (2) either that disclosure is prohibited by statute or Executive Order or that sound grounds exist which require the invocation of the exemption. A request to inspect a record located in the headquarters office or a bureau shall not be denied except on the basis of a similar determination made by the head of the bureau or his designee, and a request made to inspect a record located in a major organizational unit of the Office of the Secretary shall not be denied except on the basis of a similar determination by the head of that unit. Officers and employees of the Department shall be guided by the "Attorney General's Memorandum on the Public Information Section of the Administrative Procedure Act" of June 1967.

(b) An applicant may appeal from a determination that a record is not available for inspection to the Solicitor of the Department of the Interior, who may exercise all of the authority of the Secretary of the Interior in this regard. The Deputy Solicitor may decide such appeals and may exercise all of the authority of the Secretary in this regard.

The operator shall comply with the requirements of this Order. Any departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b).

1. *Availability of Records Filed on or after December 1, 1970.* It has been determined that certain records pertaining to leases and wells in the Outer Continental Shelf and submitted under 30 CFR 250 shall be made available for public inspection, as specified below, in the Area Office, Metairie, Louisiana.

A. *Form 9-152—Monthly Report of Operations.* All information contained on this form shall be available, except the information required in the Remarks column.

B. *Form 9-330—Well Completion or Recompletion Report and Log.*

(1) Prior to commencement of production, all information contained on this form shall be available, except Item 1a, Type of Well; Item 4, Location of Well, At top prod. interval reported below; Item 22, if Multiple Compl., How many; Item 24, Producing Interval; Item 26, Type Electric and Other Logs Run; Item 28, Casing Record; Item 29, Liner Record; Item 30, Tubing Record; Item 31, Perforation Record; Item 32, Acid, Shot, Fracture, Cement Squeeze, etc.; Item 33, Production; Item 37, Summary of Porous Zones; and Item 38, Geologic Markers.

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[1] Subsection (b) of section 552 provides that:

(b) This section does not apply to matters that are—

*   *   *

(4) Trade secrets and commercial or financial information obtained from a person and privileged or confidential;

*   *   *

(9) Geological and geophysical information and data, including maps, concerning wells.

(2) After commencement of production, all information shall be available, except Item 37, Summary of Porous Zones; and Item 38, Geologic Markers.

(3) If production has not commenced after an elapsed time of five years from the date of filing Form 9-330 as required in 30 CFR 250.38(b), all information contained on this form shall be available, except Item 37, Summary of Porous Zones; and Item 38, Geologic Markers. Within 90 days prior to the end of the 5-year period, the lessee or operator shall file a Form 9-330 containing all information requested on the form, except Item 37, Summary of Porous Zones; and Item 38, Geologic Markers, to be made available for public inspection. Objections to the release of such information may be submitted with the completed Form 9-330.

C. *Form 9-331—Sundry Notices and Report on Wells.*

(1) When used as a "Notice of Intention to" conduct operations, all information contained on this form shall be available, except Item 4, Location of Well, At top prod. interval, and Item 17, Describe Proposed or Completed Operations.

(2) When used as a "Subsequent Report of" operations, and after commencement of production, all information contained on this form shall be available, except information under Item 17 as to subsurface locations and measured and true vertical depths for all markers and zones not placed on production.

D. *Form 9-331C—Application for Permit to Drill, Deepen or Plug Back.* All information contained on this form, and location plat attached thereto, shall be available, except Item 4, Location of Well, At proposed prod. zone; and Item 23, Proposed Casing and Cementing Program.

E. *Form 9-1869—Quarterly Oil Well Test Report.* All information contained on this form shall be available.

F. *Form 9-1870—Semi-Annual Gas Well Test Report.* All information contained on this form shall be available.

G. *Multi-point Back Pressure Test Report.* All information contained on this form used to report the results of required multi-point back pressure test of gas wells shall be available.

H. *Sales of Lease Production.* Information contained on monthly Geological Survey computer printout showing sales volumes, value, and royalty of production of oil, condensate, gas and liquid products, by lease, shall be made available.

2. *Filing of Reports.* All reports on Forms 9-152, 9-330, 9-331, 9-331C, 9-1869, 9-1870, and the forms used to report the results of multi-point back pressure tests, shall be filed in accordance with the following: All reports submitted on these forms after the effective date of this Order shall include a copy with the words "Public Information" shown on the lower right-hand corner. All items on the form not marked "Public Information" shall be completed in full; and such forms, and all attachments thereto, shall not be available for public inspection. The copy marked "Public Information" shall be completed in full, except that the items described in 1(A), (B), (C), and (D) above, and the attachments relating to such items, may be excluded. The words "Public Information" shall be shown on the lower right-hand corner of this set. This copy of the form shall be made available for public inspection.

3. *Availability of Records Filed Prior to December 1, 1970.* Information filed prior to December 1, 1970, on Forms 9-152, 9-330, 9-331, and 9-331C is not in a form which can be readily made available for public inspection. Requests for information on these forms shall be submitted to the Supervisor in writing and shall be made available in accordance with 43 CFR Part 2.

4. *Availability of Inspection Records.* All accident investigation reports, pollution incident reports, facilities inspection data, and records of enforcement actions are also available for public inspection.

/s/ D. W. Solanas
Oil and Gas Supervisor
Field Operations

Approved: January 27, 1975

/s/ Russell G. Wayland
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 13
Effective October 1, 1975

PRODUCTION MEASUREMENT AND COMMINGLING

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.45, 250.60, and 250.61, and 250.68.

Section 250.60 provides as follows:

Measurement of oil. The lessee shall gauge and measure all production in accordance with methods approved by the Supervisor. The lessee shll provide tanks suitable for measuring accurately the crude oil produced from the lease (exact copies of 100 percent capacity tank tables to be furnished to the Supervisor) or may arrange with the Supervisor for other acceptable methods of measuring, storing, and recording production. The quantity and quality of all production shall be determined in accordance with the standard practices, procedures, and specifications generally used by the industry.

Section 250.61 provides as follows:

Measurement of gas. The lessee shall measure all gas production in accordance with methods approved by the Supervisor, and the measured volumes shall be adjusted to the standard pressure base of 10 ounces above the atmospheric pressure of 14.4 pounds per square inch, a standard temperature of 60° Fahrenheit, and for deviation from Boyle's law. If gas is being disposed of at a different pressure base, the Supervisor may require that gas volumes be adjusted to conform to such base.

Section 250.68 provides as follows:

Commingling production. Subject to such conditions as he may prescribe for measurement and allocation of production, the Supervisor may authorize the lessee to move production from the lease to a central point for purposes of treating, measuring, and storing, and in moving such production, the lessee may commingle the production from different wells, leases, pools and fields, and with production of other operators. The central point may be on shore or at any other convenient place selected by lessee.

The operator shall be responsible for compliance with the requirements of this Order in the installation and operation of all terminals or offshore sales points, including all facilities installed at measurement terminals or offshore sales points, whether or not operated or owned by the operator. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Definition of Terms.* As used in this Order, the following terms shall have the meanings indicated:

A. *Terminal.* Any onshore facility used in measuring the quantity and quality of produced liquids from Gulf of Mexico OCS leases for the purpose of computing royalties due the United States.

B. *Offshore Sales Point.* Any facility located on an offshore structure, at which point the produced fluids are measured by automatic custody transfer equipment, tank gauges, or meters for the purpose of computing royalties due the United States.

2. *Liquid Sales Meters.* The following requirements shall apply to all sales meters located at terminals and offshore sales points. Operators of sales meters at terminals and offshore sales points shall comply with the requirements of subparagraphs A through C by the first day of the month following six months after the date of this Order.

A. *Equipment Requirements.* Metering facilities at terminals or offshore sales points shall include the following components, which shall be compatible with the systems to which they are connected:

(1) *Meter.* Positive-displacement meter or other liquid meter approved by the Supervisor, equipped with a nonreset totalizer to remain sealed while the meter is in service. A temperature or other compensator, or a recorder, may be a component of the meter, but all such devices shall be sealed or shall be tamper proof while in service. The piping system shall be arranged to

prevent reversal of flow of liquid through the meter. Meters subjected to pressure pulsation or surges shall be adequately protected by surge tanks, expansion chambers, or similar devices. No meter shall be subjected to shock pressures which are greater than its maximum-rated working pressure. All meter installations shall be designed to operate within the gravity range specified by the meter manufacturer. The pressure and flow rate through each meter shall be maintained within manufacturer's maximum and minimum specifications for rates capacity. There shall be no bypasses around the meter.

(2) *Meter Prover*. Calibrated prover tank, master meter, or mechanical displacement proved.

(3) *Sampler*. Proportional-to-flow sampling device, with sampling point immediately upstream of the meters and downstream of any diverter valve installed upstream of the meters. The sample container shall be vaportight, with a mixing device to permit complete mixing of the sample prior to removal from the container. The sampler probe shall extend into the center of the flow piping in a vertical run. The probe shall always be in a horizontal position. The composite sample accumulated in a run period, which is the basis of the gravity and BS&W measurements, shall be representative of all crude oil delivered.

(4) *Deaerator*. When a deaerator is utilized, it shall be located upstream of the meters and shall in no case be of a smaller rated maximum capacity than that of the pump or feed lines and shall provide complete air elimination.

(5) *BS&W Monitor*. When a BS&W monitor is used it shall be installed upstream of the meters and sampling device, and designed to sound an alarm, shut down the pumps, or to divert the liquid stream back to the treater vessels, water separation tanks, or bad-oil tank in the event excessive BS&W content is detected in the oil.

B. *Gravity, BS&W, and Temperature Determinations*. The volume of metered oil shall be corrected, using factors determined as follows:

(1) *API Gravity*. The hydrometer method is the most suitable for determining the API gravity of crude petroleum. The testing procedure shall be in accordance with API Standard 2544 and ASTM Designation D287-67, Standard Method of Test for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method), 1967.

(2) *BS&W*. Determination of water and sediment in crude oils shall be in accordance with API Standard 2542 and ASTM Designation D96-68, Standard Methods of Test for Water and Sediment in Crude Oils (1968).

(3) *Temperature*. Determination of the average temperature necessary to calculate volumes at a standard temperature of 60° Fahrenheit shall be in accordance with API Standard 2543 and ASTM Designation D1086-64, American Standard Method of Measuring the Temperature of Petroleum and Petroleum Products (1964), except when the volume is determined from a temperature-compensated or temperature-recording meter.

C. *Sales Meter Proving Requirements*. The following meter proving procedures shall be followed by all operators of liquid sales meters. Calibration of the sales meters shall be witnessed by purchaser (if different from the seller), USGS, or other party acceptable to the Supervisor.

(1) *Certification*. The integrity of the calibration of each mechanical displacement prover or prover tank or master meter must be traceable to test measures which have been certified by the National Bureau of Standards.

(2) *Frequency*. Each operating meter or master meter shall be proved every month within a tolerance of fifteen (15) days, or at any other time upon request of the Supervisor.

(3) *Establishing Meter Factors*.

(a) *Prover Tank*. In establishing the meter factor with a prover tank, proof runs shall be made and recorded until two (2) consecutive runs have results within a tolerance of 0.0005 (.05 percent) prover tank volume. An average of the results of these two (2) runs will be used for the meter factor.

(b) *Master Meter*. In establishing the operating meter factor with a master meter, the master meter shall first be operating within manufacturer's specifications, calibrated with similar gravity crude and flow rate. Proof runs shall be made until three (3) consecutive runs have results within a tolerance of 0.0002. The volume of each run shall be at least ten (10) percent of the hourly rated capacity of the operating meter but must be of sufficient amount for determination of an accurate operating meter factor. The master metering installation shall include:

(i) A back-pressure valve downstream of the operating and master meter.

(ii) A check valve to prohibit back flow.

(c) *Mechanical-Displacement Prover*. In establishing the operating meter factor with a mechanical-displacement prover, a minimum of five (5) out of six (6) consecutive runs for an unidirectional prover or round trips for a bidirectional prover shall be within a tolerance of 0.0005. An average of these five runs will be used to compute the meter factor.

(d) *Preliminary Run*. For any of the three methods of proving the operating meter (prover tank, master meter, or mechanical-displacement prover), a preliminary unrecorded run should be made to equalize temperatures, displace vapors or gases, and wet the interior of the prover, where necessary. More than one run may be made. If four consecutive prover runs are made without any two consecutive runs checking within the 0.0005 tolerance, the installation shall be inspected; and if inspection discloses mechanical defects, necessary repairs shall be made.

(e) *Fluid Compressibility*. In calibrating meters with a mechanical-displacement prover, or master meter, or pressurized prover tank (volumetric provers) fluid compressibility shall be taken into account (API Standard 1101, Table II). This factor is referred to as Cpl.

(f) *Other Required Considerations*. In calibrating meters with a mechanical-displacement prover or pressurized prover tank, the following correction factors shall be taken into account:

(i) The change in prover volume due to pressure in the steel pipe (API Standard 2531, USA Standard for Mechanical-Displacement Meter Provers, Table II, Steel Correction Factor for Pressure, Cps (1963)). This correction factor is referred to as Cps and will always be unity or greater.

(ii) The change in volume of the test liquid with change in temperature as determined from API Standard 2540 and ASTM-D1250, Table 6, "Reduction of Volume to 60° F against API gravity at 60° F," (1952) or expanded tables based on the same. This correction factor is referred to as Ctl.

(iii) The change in tank shell dimensions with change in temperature (API Standard 2531, "USA Standard for Mechanical Displacement Meter Prover," Table I, "Steel Correction Factor for Temperature, Cts.," App. B (1963)). This correction factor is referred to as Cts.

(iv) API Standard 2541 and ASTM Designation D1750-62, "Standard Tables for Positive Displacement Meter Prover Tank" (1966), Table A, or expanded tables based on same, may be used where applicable. This table is a combined factor for temperature correction of liquid and steel (API Standard 2540 and ASTM Designation D1250-56, "Standard Petroleum Measurement Tables" (1966), Table 6, "Reduction of Volume to 60° F against API Gravity at 60° F," combined with a temperature factor for the cubical expansion of mild steel).

(g) *Deviation and Meter Factor*. A maximum deviation of ±0.0025 in any factor obtained since a meter was last proved or repaired, or from the original factor with a new meter, will be allowed without declaration of a malfunction. Any factor which exceeds this limit will be declared a malfunction factor. It shall be clearly indicated on the proving report when a malfunction factor has been obtained. If a malfunction factor occurs, the operator shall submit a Meter Adjustment Ticket (Form 9-1910) to adjust the volume of oil run during the period ending with the malfunction factor. The factor obtained at the beginning of the run will be used on the current ticket in the meter printer. Adjustments to the calculated run volume will be indicated on the Meter Adjustment Ticket and will eliminate the necessity of changing or adjusting the total production figure shown on the meter totalizer.

(4) *Meter Malfunction*. After a malfunction, an operating meter shall be repaired or adjusted, and recalibrated as required. The proving report must indicate the repairs or maintenance which were performed. The operator shall have a run ticket made within 24 hours after proving any sales meter and shall submit copies of all such run tickets to the Area office within 7 days after completion.

(5) *Proving Report Forms*. Meter Proving Report A (Form 9-1912) shall be used when proving meters using mechanical-displacement prover. Meter Proving Report B (9-1913) shall be used when performing meter provings using prover tanks or master meter. The operator shall submit a copy of the official proving record to the Area office within seven days after proving a meter.

3. *Sale Tanks.* Operators of liquid sales tanks and facilities shall comply with the following:

A. *Equipment Requirements.* To reduce evaporation losses, sales tank facilities shall be equipped with a pressure-vacuum thief hatch and vent-line valve, and a fill line designed to minimize free fall and splashing.

B. *Calibration Chart.* A complete set of calibration charts (tank tables) for each tank shall be submitted to the Area office. Tank calibrations shall be according to API Standard 2550 and ASTM Designation D1220-65, "Measurement and Calibration of Upright Cylindrical Tanks" (1966) and shall be performed by qualified personnel, subject to witnessing by representatives of the purchaser, seller, and USGS.

C. *Gauging and Sampling.* Gauging of storage tanks shall be performed according to API Standard 2545, and ASTM Designation D1085-65, "USA Standard Method of Gauging Petroleum and Petroleum Products" (1965), and sampling of petroleum and petroleum products in accordance with API Standard 2546 and ASTM Designation D270-65, "Standard Method of Sampling Petroleum and Petroleum Products" (1965).

D. *Temperature Correction.* The change in volume of the liquid with the change in temperature shall be determined from API Standard 2540 and ASTM Designation D1250, Table 6, "Reduction of Volume to 60° F against API Gravity at 60° F" (1952), or expanded tables based on the same. Reduction for BS&W shall be made after making the correction for temperature.

4. *Allocation Meter Facilities.* Allocation meter facilities shall include the following components:

A. *Meter.* Positive-displacement meter, positive volume meter, turbine meter, or other acceptable measurement equipment.

B. *Meter Prover.* Calibrated mechanical-displacement prover, master meter, or prover tank.

C. *Sampler.* Equipment for continuous or periodic liquid sampling.

5. *Gas Measurement.* The operator shall be responsible for compliance with the requirements of this Order pertaining to all sales meters at their delivery points and all meters used for allocation purposes.

A. *Standards for Measurement.* The following requirements shall apply to all meters:

(1) *Equipment.* The measuring equipment so installed shall conform to and shall be operated in accordance with the specifications and the recommendations contained in the American Gas Association publication Orifice Metering of Natural Gas, Gas Measurement Committee Report No. 3, including the appendix as published September 1969.

(2) *Deliveries.* The volume of gas delivered shall be in accordance with the specifications and the recommendations contained in said Gas Measurement Committee Report No. 3.

B. *Specifications for Measurement.* The following requirements shall apply to all gas meters:

(1) *Sales Unit.* For purposes of reporting sales, the measurement unit shall be one MCF of gas (1,000 cubic feet).

(2) *Unit of Volume.* For purposes of Calculation, the unit of volume shall be one cubic foot at a base temperature of 60° Fahrenheit and at a base pressure of 15.025 pounds per square inch absolute.

(3) *Pressure Base.* For purposes of measurement and meter calibration, the atmospheric or barometric pressure shall be assumed to be constant at 14.7 pounds per square inch absolute.

(4) Test Frequency. The accuracy of the measuring equipment at the point of delivery or allocation shall be tested at reasonable intervals, not to exceed forty-five (45) days.

(5) *Malfunction.* If at any time the measuring equipment is found to be out of service or not registering within the limits prescribed by the manufacturer, it shall be repaired or adjusted to read accurately. If the error in the measuring equipment is found to be within two percent, previous readings of such equipment shall be considered correct in computing the deliveries of gas thereunder. If the error in the measuring of equipment is found to be more than two percent, the volume measured since the last calibration shall be corrected. The volume adjustment should be calculated from the time the error occurred, if such time is ascertainable, and if not ascertainable, then back one-half of the time elapsed since the last date of calibration or as much as 23 days. If for any reason the measuring equipment is out of service or malfunctioning with the result that the quantity of gas delivered is not known, the volume of gas delivered through the period during which such equipment is out of service or malfunctioning shall be estimated on the basis of the best data available, using one of the following methods in order of priority.

(a) By using the registration of any check-measuring equipment if installed and accurately registering; or

(b) By correcting the error if the percentage of error is ascertainable by calibration, test, or mathematical calculations; or

(c) By estimating the quantity of delivery by reference to actual deliveries during preceding periods under similar conditions when the unserviceable equipment was registering accurately.

C. *Witnessing.* The tests and calibrations made under Paragraph B above shall be run by qualified personnel. Representatives of the seller, buyer, and USGS shall have the right to witness such tests and calibrations.

D. *Record Retention.* The operator shall preserve or cause to be preserved all test data, meter reports, charts, or other similar records for a period of not less than one year. At any time within such period, the Supervisor may request such records and charts, subject to return within 20 days from receipt thereof.

E. *Record Submittal.* Upon request, one copy of the meter reports specified in D above shall be forwarded to the Supervisor. No special form is required, but all meter report forms shall include the following information where applicable:

(1) *Producer or Seller.*

(2) *Purchaser.*

(3) *OCS lease number or other identifying designation.*

(4) *Station or meter number.*

(5) *Time and date of test.*

(6) *Location.*

(7) *Meter data (make, serial number, differential range, static range).*

(8) *Type connections (flange or pipe).*

(9) *Orifice data ("found" and "left" for line size and orifice size).*

(10) *Zero data for differential and for static spring.*

(11) *Calibration data ("found" and "left" for differential and for static).*

(12) *Remarks.*

(13) *Signature and affiliation of tester.*

(14) *Signature and affiliation of witness.*

6. *Commingling of Production.* Commingling production of different ownership and/or from different leases prior to sales shall be subject to the approval of the Supervisor prior to the actual commingling. Unless otherwise established, the sales delivery shall be considered on the lease and appropriate measurement shall be provided. Well production test may be approved for allocation purposes.

A. *Applications.* Applications for approval of a commingling procedure shall contain the following information:

(1) An accurate description of any measuring devices and samplers, including schematics of the total system, and detailed sections.

(2) A list of the leases and fields involved.

(3) The estimated amounts and types of production involved.

(4) Details of the allocation procedure.

(5) Description of calibration equipment and intervals.

(6) Sales contract, agreement for disposal, or posted price.

B. *Allocation Schedule.* If production from more than one lease or owner is measured by the same sales meter, an allocation schedule of the monthly sales volume of commingled production shall be furnished to the Supervisor. The allocation schedule shall contain:

(1) Total sales volume.

(2) All storage volumes located upstream of the sales meter on the first and last day of the month.

(3) Total lease production from actual allocation meter readings with appropriate corrections (if allocated by meter measurements).

(4) Total lease production calculated from required well tests (if allocated by well test).

(5) Final allocation of actual sales to contributing leases.

7. *Automatic Custody Transfer.* Automatic custody transfer shall be subject to approval of the Supervisor.

A. *Application.* An application to the Supervisor for approval of the meter measurement and facilities shall include:

(1) Flow schematic of the ACT Unit showing and labeling all components.

(2) Leases and fields involved.

(3) Estimated amounts and types of production involved.

(4) Calibration documents for the prover.

B. *ACT Failure.* Any ACT failure, such as electrical, meter, prover loop, or other failure (this does not include malfunction as defined in subparagraph 2.C.(4) of the Order), which may require other methods of measurement shall be reported to the Supervisor within 24 hours. The Supervisor shall approve other methods of measurement during the ACT failure period. A complete, detailed report shall be submitted to the Supervisor within 10 days.

8. *Accidents.* Any accident causing fire, damage to equipment, serious injuries, or pollution shall be reported to the Supervisor within 24 hours. A complete, detailed report shall be submitted to the Supervisor within 10 days.

/s/ J. B. LOWENHAUPT
Oil and Gas Supervisor
Production Control
Gulf of Mexico Area

APPROVED:

/s/ RUSSELL G. WAYLAND
Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

OCS ORDER NO. 14

Effective January 1, 1977

APPROVAL OF SUSPENSIONS OF PRODUCTION

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.12(d).

If the Supervisor in his discretion approves a request for suspension of production pursuant to 30 CFR 250.12(d)(1), the terms of the lease will not be deemed to expire as long as the suspension remains in effect.

The Supervisor may not approve a request for a suspension of production to facilitate proper development of a lease because of a lack of transportation facilities unless he is satisfied that the lessee: (1) has made the request in good faith; and (2) is taking and will continue to take all reasonable actions to place the leasehold on production in accordance with applicable laws and regulations.

1. *Suspension of Production to Facilitate Proper Development.* A lease on which a well has been drilled and determined by the Supervisor to be capable of being produced in paying quantities according to the provisions of OCS Order No. 4 and thereafter temporarily abandoned or permanently plugged and abandoned is being properly developed if the lessee:

A. is waiting for completion of drilling platform construction and installation or delivery of equipment or facilities which are necessary for production and for which the lessee has signed a contract that specifies a delivery date; or

B. has pending before any Federal, State, or local government authority, an application for a permit which is necessary before the lessee can produce oil or gas from the lease; or

C. has submitted to the Department of the Interior a development plan or unitization agreement for the lease and is waiting for the Department to complete action on the plan or agreement; or

D. has submitted to the Department of the Interior and is actually conducting a geological and geophysical exploration or development program that includes drilling to develop sufficient reserves to produce either from the lease alone or in connection with other leases. For purposes of receiving a suspension under this provision, drilling activity on one lease may be determined by the Supervisor to be activity on all leases which are to be considered as a unit for purposes of providing sufficient reserves to establish economic justification for development wells, structures, facilities, and/or pipelines to recover, process, and transport such reserves as necessary; or

E. because of water depth or bottom conditions, is developing new and special production equipment, apparatus devices, or techniques in order to obtain, bring about, or create actual production capability.

2. *Suspension of Production Because of Lack of Transportation Facilities.* A lease on which a well has been drilled and determined by the Supervisor to be capable of being produced in paying quantities, according to the provisions of OCS Order No. 4, and thereafter temporarily abandoned or permanently plugged and abandoned and cannot be produced because of lack of transportation facilities, is being properly developed if the lessee:

A. is waiting for the completion of pipeline construction or delivery of pipeline equipment or facilities which are necessary for the transportation of oil and gas and for which the lessee has signed a contract that specifies the completion or delivery date; or

B. has pending before any Federal, State, or local government authority, an application or a permit which is necessary before the lessee can transport oil and gas from the lease; or

C. has a contract to use an existing pipeline, but is unable to use the pipeline for reasons beyond the lessee's control.

/s/ J. B. Lowenhaupt
Oil and Gas Supervisor
Production Control
Gulf of Mexico Area

Approved:

/s/ Russell G. Wayland
Acting Chief, Conservation Division

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

PROPOSED OCS ORDER NO. 15
Effective

SUBMITTAL OF INFORMATION CONCERNING DEVELOPMENT PLANS TO COASTAL STATES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.34, and applies to those States without a coastal zone management program approved by the Secretary of Commerce in accordance with the Coastal Zone Management Act of 1972 and amended in 1976. Section 250.34, as revised November 4, 1975 (40 FR 51199), provides in part as follows:

Development Plan. Prior to commencement of a development program on a lease, a plan of development shall be submitted to the Supervisor for approval. On leases issued after November 4, 1975, the Supervisor shall furnish a copy of the plan to the Governors of directly affected States except for that information identified by the Freedom of Information Act (P.L. 90-23) as being excluded from disclosure. The Governors shall have 60 days from receipt of this information in which to review and comment on the proposed plan.

Information for States. For any lease issued after November 4, 1975, the lessee shall deliver to the Governor of each directly affected State information concerning the onshore and offshore impact of the proposed plan of development. Such delivery shall be made 30 days before submission of the relevant development plan. The lessee shall notify the Governor and the Supervisor when final delivery of this information has been made.

The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Directly Affected States.* For the purpose of this Order, the States considered affected by operations in the Area are listed in Appendix A.

2. *Information to be Submitted to the States.* At least 30 days prior to submitting a plan of development for lease or unit operations to the Supervisor for approval, the lessee or operator shall furnish the Governor, or his designated representative, of each directly affected State and the Supervisor its assessment of the following information:

A. *Location.* The location, as to county, parish or general purpose local government, the size of any offshore and land-based facilities to be constructed, leased, or otherwise acquired or expanded, or offshore and land-based operations to be conducted or contacted for as a result of the proposed lease activity shall be identified and include:

(1) The amount of acreage required with the State for facilities and storage, right of way, and easements.

(2) The means to be used to transport oil and gas to shore, the routes such transportation will follow, and where possible, the estimated quantity of the oil and gas moving along such routes.

(3) An estimate of the frequency of boat and aircraft departures and arrivals, on a monthly basis, the onshore location of terminals, and the normal routes to be followed by each mode of transportation.

B. *Resource Requirements.* The requirements for land, labor, materials, and energy for the items identified in paragraph A above shall be stated and include:

(1) The approximate number of persons who will be engaged in onshore support activities and transportation, the approximate number of local personnel who will be employed for or in support of the development programs, indicating the major skills or crafts required from local sources and the estimated number of each such skill needed, and the approximate total number of persons who will be employed for the development programs.

(2) The approximate addition to the population of the local jurisdiction because of the development programs and the approximate number of persons needing housing and other facilities.

(3) An estimate of any significant quantity of natural resources, including water, aggregate, or other major supplies and equipment to be procured within the States.

(4) The types of contractors or vendors which will be needed, although not specifically identified, which will place a demand on local goods and services such as transportation, food services, security, etc.

C. *Timeframe.* The timing of the development operations shall be estimated including:

(1) Sequence of events.

(2) Best estimate of time involved to complete the operations.

(3) When the actions are most likely to occur onshore and offshore.

D. *Personnel Involved.* List the names and addresses of the companies or contractors, known or anticipated, who will be conducting the various activities.

E. *Alteration of Plans.* Events that may with a reasonably good probability occur to significantly alter the proposed operations with respect to onshore impacts, including changes in oil and gas transportation operations, shall be described as well as how such operations shall be altered.

F. *Responsibility.* The lessee shall name a responsible individual knowledgeable in the provisions of the development plan with whom inquiries may be made by State representatives for purposes of clarification or explanation of the information provided. However, any request for additional information must be made to the Supervisor.

3. *Adequacy of Information.* If the Governor of an affected State, or his designated representative, advises the Supervisor within 30 days of receipt of the information provided by the lessee or operator that in the judgment of the State the requirements of paragraph 2 above have not been fulfilled, the Supervisor shall forward the information furnished by the lessee or operator, the comments from the State representative, and the stated position of the lessee or operator through the Regional Conservation Manager and the Chief, Conservation Division, to the Director for his determination as to the adequacy of the information.

The State representative and the lessee or operator shall be advised by the Supervisor of the Director's findings. If additional information is required to be submitted by the lessee or operator, the 60-day period of time for review by the States of a subsequently submitted plan of development shall not be considered to have commenced until such information has been received by the State.

4. *Development Plan.* The lessee or operator shall submit development plans for lease or unit areas at least six months in advance of the contemplated date for commencement of operations in order to allow time for an adequate review by personnel from the States and the Supervisor.

A. *Certificate of Information.* The lessee or operator shall certify on each plan of development for a lease or unit area submitted for approval that the directly affected States have received the information set forth in paragraph 2 above at least 30 days prior to submission of the plan of development to the Supervisor. If any State does not desire the information, this fact should be stated and appropriate evidence from the State should be furnished.

B. *Proprietary Information.* The lessee or operator shall identify the information in the plan of development which, in his opinion, is excluded from required public disclosure by Subsection 552(b)(4) and (9) of the Public Information Act, e.g., (1) trade secrets and commercial or financial information and (2) geological and geophysical information, data, and maps concerning wells.

C. *State Review of Development Plans.* The plan of development, excluding that information identified in paragraph 4.B. which is approved for exclusion by the Supervisor, shall be provided by the Supervisor to the Governor, or designated representative, of each directly affected State. No approval action on the plan will be taken by the Supervisor until comments are received from the appropriate State personnel or 60 days have elapsed from the date on which the State received the plan.

D. *Amendments to Plans of Development.* The operator shall submit amendments to a plan of development, including amendments which are determined to be minor, to the Supervisor and to the Governor or designated representative of each directly affected State. If the amendment is considered significant by the Supervisor, the review period may be extended for a period not to exceed 60 days from the States' receipt of the amendment.

An amendment may be considered significant if it results in an alteration of facilities or operations onshore and offshore that would change the impact.

5. *Modifications of Approved Plans of Development.* The lessee or operator shall submit to the Supervisor for approval a request for modification of an approved plan of development. If such modification, in the opinion of the Supervisor, would result in significant alteration of facilities or operations onshore and offshore, the procedures specified in the preceding paragraphs shall be followed.

6. *Extension of Leases*. Upon request of a lessee, the Supervisor may approve a suspension of operations for a nonproducing lease equal to the period of time in excess of 60 days which may be required for the previously described review, if such delay is not caused by the lessee and is in the interest of conservation.

/s/ Supervisor

APPROVED:

/s/ Chief, Conservation Division

APPENDIX A

Mid-Atlantic (Sales 40 and 49) - New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina.

North Atlantic (Sales 42 and 52) - New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine.

South Atlantic (Sales 43 and 54) - North Carolina, South Carolina, Georgia, and Florida.

Pacific (Sales 35, 48, and 53) - California.

Pacific (Sale 53) - Oregon and California.

Gulf of Mexico (East) (Sales 41 and 47) - Mississippi, Alabama, and Florida.

Gulf of Mexico (Central) (Sales 41, 44, and 47) - Louisiana.

Gulf of Mexico (West) (Sales 41, 44, and 47) - Texas.

Gulf of Alaska, Lower Cook Inlet, Bering Sea, Beaufort Sea, Outer Bristol Basin, Chukchi Sea (Sales 39, 45, 46, 50, and 51) - Alaska.

Appendix C

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
GULF OF MEXICO AREA

75-3
(SUPERSEDES No. 74-10)

January 20, 1975

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO AREA

MINIMUM GEOPHYSICAL SURVEY REQUIREMENTS TO PROTECT CULTURAL RESOURCES

Recent OCS leases include stipulations concerning archaeological surveys. Should such an archaeological survey be required in the leased area, or area sought for permit, the following minimum requirements must be fulfilled. These requirements will be effective as of the date of this notice and shall apply also to all existing leases that contain archaeological stipulations, including MAFLA leases, where the archaeological surveys have not yet been conducted.

Prior to drilling operations or the installation of any structure or pipeline, the lessee shall conduct a high resolution geophysical survey in the immediate area to determine the possible existence of a cultural resource. The following equipment is required in performing the survey. All equipment shall be representative of the state of technological development.

A. Magnetometer - Total field intensity instruments are needed. The sensor of the magnetometer should be trailed as near as possible to the sea floor; six meters or less is recommended. Knowledge of the sensor depth of tow above the bottom is highly desirable for future analyses.

B. Dual Side Scan Sonar - Coverage of the sea floor at a range width of at least 150 meters per side in the proposed area is needed.

C. Depth Sounder and Sub-bottom Profiler - An analog recorder shall be used for bathymetry and the profiler shall be capable of resolving the upper 50 feet of sediment.

Navigation for the survey shall utilize state-of-the-art positioning systems correlated to annotated geophysical records. Navigation accuracy shall be on the order of $\pm$ 50 feet at 200 miles.

Optional tools could include cameras, underwater TV, divers, and cores. Any engineering soil borings which are obtained shall be made available for the archaeologist's inspection. These data shall be evaluated for indications of aboriginal habitation sites as well as for historic sites.

The track or survey line spacing shall follow the attached illustrated plans.

For a single-drill site or platform location, all geophysical equipment shall run an area approximately one mile square with eleven principal survey lines spaced 150 meters apart with three cross-lines. In addition, two diagonal lines centered on the proposed drill site shall be run. (See attached plan A).

For an entire lease block, or significant portions, a 150 meter x 1000 meter spacing shall be used. (See attached plan B).

For a pipeline installation, three principal survey lines shall be run, one following the exact course of the proposed pipeline with an offset line on either side spaced to coincide with the area which would be disturbed by the barge anchors. The distance of these offset lines from the proposed pipeline route cannot be stated specifically since this is a function of water depth and equipment. (See attached plan C).

A professional underwater archaeologist is not required to be present on all survey activities. A geophysicist must accompany the survey to insure that the equipment is properly tuned and records are accurate and readable. The records shall be inspected by the archaeologist along with the survey geophysicist who shall advise the archaeologist as to the record quality and anomaly occurrences. The data will be maintained by the lessee and shall be available to BLM and USGS upon request.

Survey Report Format

The archaeological survey shall include, as a minimum, the following:

1. Description of tract surveyed to include tract number, OCS number, block number, geographic area, e.g., Mobile South No. 1 Area, and water depth.

2. a) Map (1" = 2,000') of the lease block showing the area surveyed.

   b) Navigation postplot Map (1" = 1,000') of area surveyed showing tract lines and shotpoints with U.T.M. X and Y coordinates and latitude-longitude reference points.

3. Survey personnel and duties.

4. Survey instrumentation, procedures and logs.

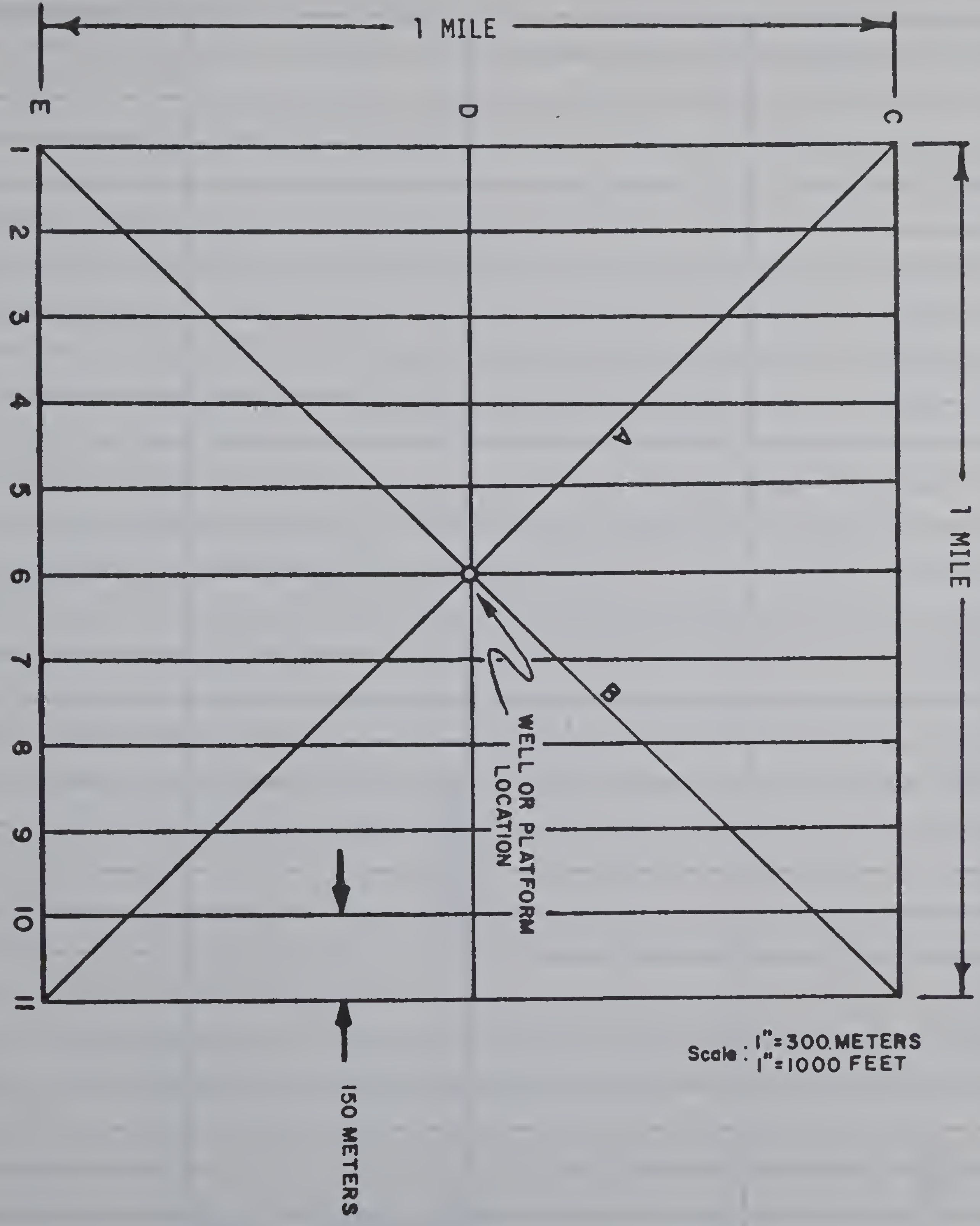
5. Sea state.

6. The original of a selected line of survey data for each instrument used shall be submitted with each report. In all cases where an anomaly is encountered, the original of all survey data for the line(s) indicating the anomaly shall be submitted.

7. Archaeological assessment, with a signed statement as to the possible existence of a cultural resource.

8. Two copies of the report shall be submitted to this office and also two copies to the New Orleans OCS office, BLM.

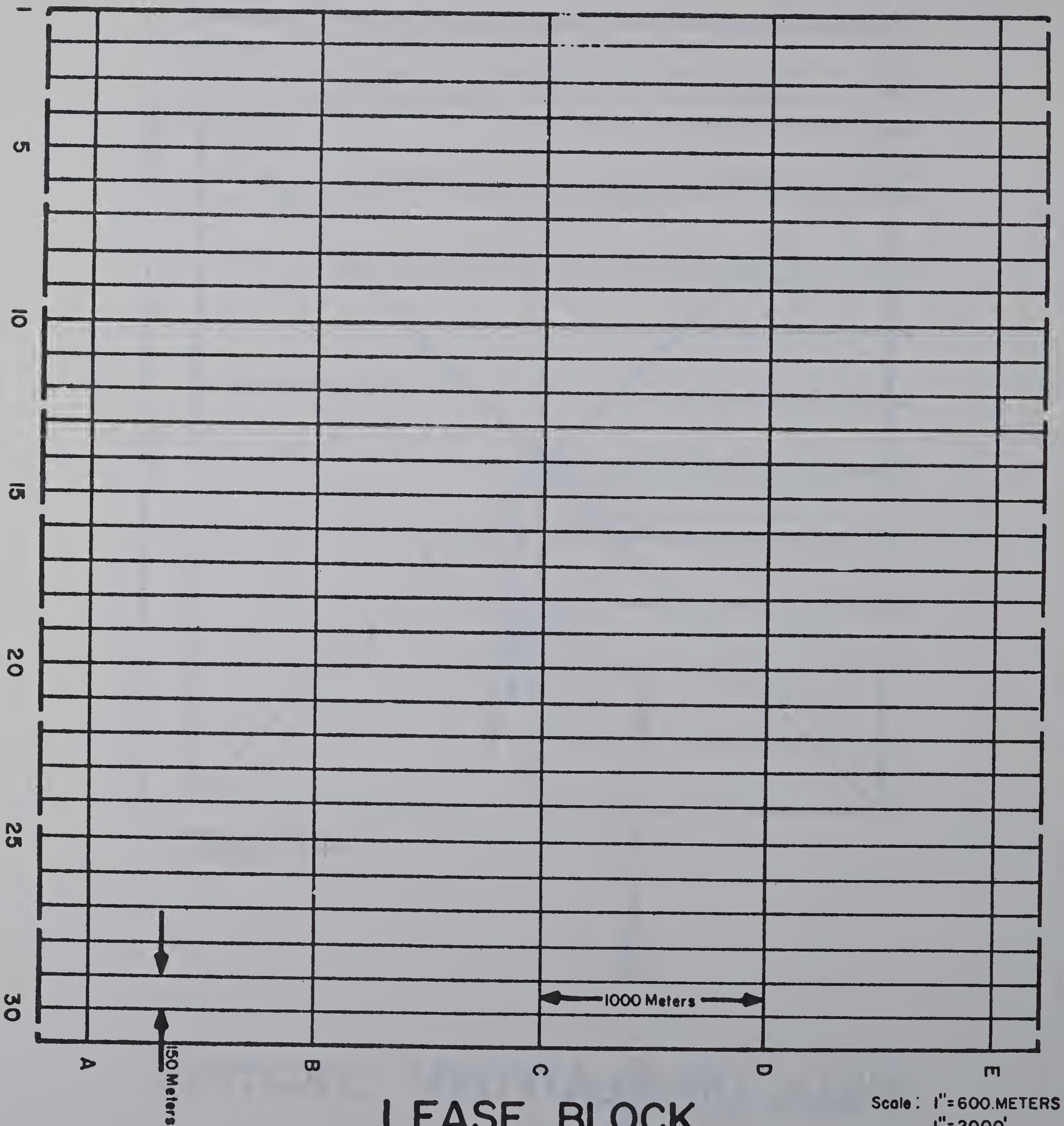
/s/ D. W. Solanas
Oil and Gas Supervisor
Field Operations
Gulf of Mexico Area



WELL OR PLATFORM LOCATION

GEOPHYSICAL SURVEY GRID TO DETERMINE THE EXISTENCE OF CULTURAL RESOURCES

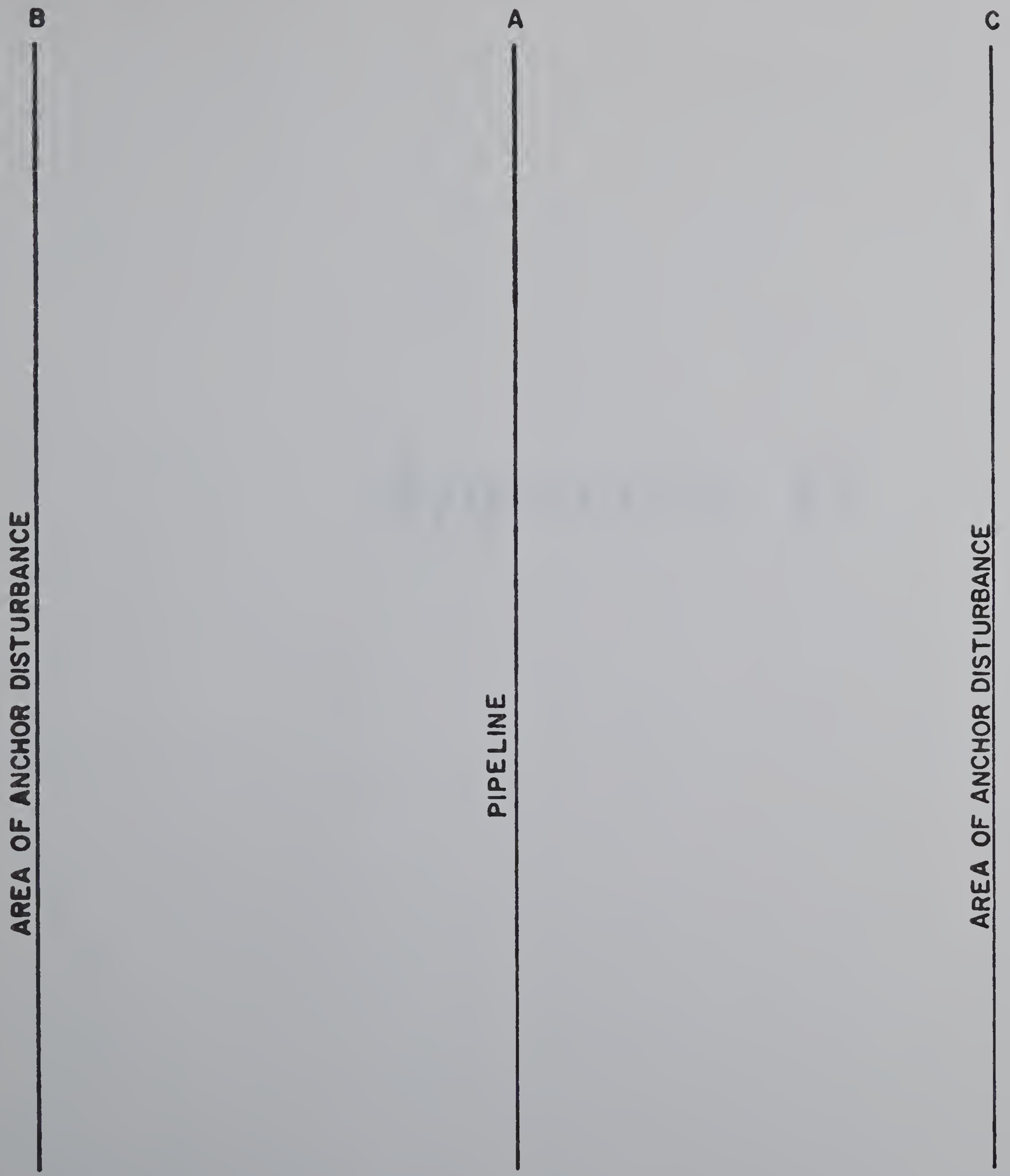
PLAN "A"



LEASE BLOCK

GEOPHYSICAL SURVEY GRID TO DETERMINE THE EXISTENCE OF CULTURAL RESOURCES

PLAN "B"



PROPOSED PIPELINE ROUTE

No Scale

GEOPHYSICAL SURVEY GRID TO DETERMINE THE EXISTENCE OF CULTURAL RESOURCES

PLAN "C"

Appendix D

Matrix Analysis of Potential Impacts on Major Resources and Activities

1. Purpose

The purpose of this matrix analysis is to analyze some of the potential impacts of the proposed OCS lease sale by way of a matrix analytical technique in an attempt to provide the decision-maker and reviewer with an array of factors which must be considered in order to form value judgments concerning the importance of these interactions.

In this section, each tract is included in a table designed to describe its distance from shore, water depth and expected type of production. In addition, the sensitivity of major resources and activities to impacts of oil spills, should one occur, and to impacts of structures, should the tract be developed, is evaluated by means of a sensitivity rating for both spills and structures.

2. Significant Resource Factors

The matrix analysis examines major resource categories which could sustain negative impacts as a result of the development of the tracts included in the proposed lease sale. Significant resource factors appear on the horizontal axis of each matrix, and for purposes of this analysis have been identified to consist of:

littoral systems—all shoreline features
reefal systems—high relief banks with dense epifaunal communities
benthic systems—ecosystems composed of bottom-living organisms
endangered species—critical habitat of those species considered endangered by the U.S. Fish and Wildlife Service
commercial and sport fishing—shrimp, menhaden, industrial fish and hook and line fishing offshore
shipping—major shipping lanes
aesthetics—visibility of exploratory drilling rigs, production platforms and other structures
outdoor recreation—inshore hunting, fishing and boating cultural resources—potential nearshore archaeological sites

All evaluations of the above categories were based on measurement from the edge of the tract closest to the resource potentially affected.

3. Impact Producing Factors

This evaluation considers the sensitivity of significant resources and activities to the occurrence of oil spills and structures within the proposed sale area as being the primary factor. "Oil spills" in this context refers to spills of 100,000 gallons (2,381 bbls) or more (the volume designated as a major spill by the National Oil and Hazardous Substances Pollution Contingency Plan), and structures include platforms or other fixed structures and artificial islands.

Other impact-producing factors, such as debris resulting from drilling activities, and pipeline construction, cannot be analyzed on a tract-by-tract basis, and therefore, are not included in this matrix section. However, these and other related factors were discussed on the basis of this proposed sale in previous parts of this section, Environmental Impact of the Proposed Sale Section.

4. Sensitivity Rating

Each tract has been assigned sensitivity values for oil spills and structures based primarily on the distance from a particular resource.

A series of scales has been devised for the purpose of assigning a range of values to indicate sensitivity to each impact-producing factor. These scales are presented below and consist of three levels of potential magnitude of impact.

3-Maximal potential impact
2-Moderate potential impact
1-Minimal potential impact

The judgment of the importance of any specific impact is at the discretion of the decisionmaker or reviewer.

a. Structures

An estimate of the importance of the impact of structures on the environment consist of two factors: quantity in this case it is estimated that all tracts 2,023 hectares or more in size will average two structures per tract, even though some tracts may never be developed; and time all structures will remain on site for an average period of fifteen to twenty years.

Structures are considered to be potentially negative impacts to four of the significant resource factors mentioned previously: reefal systems, commercial and sport fishing, shipping, and aesthetics.

Reefal systems containing coral and associated organisms are very sensitive to disturbances such as the turbidity created by the discharge of drill muds and cuttings. Also, nektonic population distribution may be affected by the presence of a structure. Therefore, the sensitivity ratings for reefal systems reflects these considerations and is purposely conservative due to our lack of information with regard to the distribution of drill muds and cuttings under operational conditions in marine systems.

Structures interfere with commercial fishing by removing trawling and purse seining areas. Approximately 70 percent of the catch by these two methods in the Gulf of Mexico is shoreward of the 20 m isobath. The remainder of the catch by these methods is concentrated between the 20 m and the 200 m isobath with only nominal effort expended beyond these depths.

Structures pose a collision hazard to shipping and boating in general but are especially hazardous when placed near fairways or anchorage areas and are rated accordingly.

The aesthetic sensitivity ratings are based on the visibility from sea level of a 33 m tall structure. Within 16 km of shore, such a structure would be obvious, whereas 17 to 25 km from shore the structure would be hardly visible and greater than 25 km from shore the aesthetic impact would be negligible except from the point of view of the boating community.

The above considerations resulted in the following sensitivity rating for structures:

Reefal Systems

3-1.5 km or less from known reef
2-1.5 to 5 km from known reef
1-greater than 5 km from known reef

Sport and Commercial Fishing

3-within 20 m depth contour
2-within 200 m depth contour
1-outside 200 m depth contour

Shipping

3-within 1.5 km of fairway or anchorage
2-1.5 to 5 km of fairway or anchorage
1-greater than 5 km from fairway or anchorage

Aesthetics

3-within 16 km of shore
2-17 to 25 km from shore
1-greater than 25 km from shore

b. Oil Spills

The factors for estimating the importance of oil spills on the environment are: quantity--our analysis is based on all spills of 100,000 gallons or more (2,381 bbls); and time--the toxicity of oil is known to decrease with weathering. For analytical purposes, we have assumed a rate of 0.5 knots which for weathering times of 24, 48 and 72 hours gives impact zones of 12, 24, and 36 nautical miles (19.3, 38.6, 57.9 kilometers). Using toxicity at 24 hours as a base, laboratory bioassays indicate that at 48 hours the toxicity will be 0.90 of that base, and that this weathering factor will decrease by 0.03 for each 2 hours of weathering to a minimum of 0.54 after 72 hours (R. P. Hannah, personal communications). Therefore, assigned sensitivity values of biological systems are adjusted from a potential spill site by the appropriate weathering factor.

Oil spills are considered to be potentially damaging to all of the previously listed resource factors except shipping.

If a spill were to occur within 16 km (10 miles) of any resource, it probably could not be effectively contained before contacting the resource. For this reason, the highest sensitivity rating was established for 16 km or less from littoral systems, reefal systems, endangered species, aesthetics, outdoor recreation and cultural resources. Within 17 to 32 km the probability that oil would contact a resource is sufficient enough to warrant concern. Beyond 32 km the possibility of contact still exists but is considered to be minimal.

The sensitivity ratings for benthic systems and sport and commercial fishing is based upon depths to which oil can be expected to be entrained in the Gulf of Mexico. In nearshore areas 10 m or less in depth, a spill will almost certainly contact bottom sediments increasing the potential for damage to benthic systems and tainting of demersal fish species. Under extreme conditions of mixing energy, the depth to which oil might be entrained can be assumed to be 20 m or less. Sediments at depths greater than 20 m have little chance of being contaminated except in the immediate vicinity of the spill site.

The above considerations resulted in the following sensitivity rating for oil spills:

Littoral system

3-within 16 km of shore
2-17-32 km from shore
1-greater than 32 km from shore

Reefal system

3-within 16 km of reef
2-17-32 km from reef
1-greater than 32 km from reef

Benthic system

3-10 m depth or less
2-11-20 m depth
1-greater than 20 m depth

Endangered species

3-within 16 km of critical habitat
2-17-32 km from critical habitat
1-greater than 32 km from critical habitat

Sport and Commercial fishing

3-10 m depth or less
2-11-20 m depth
1-greater than 20 m depth

Aesthetics

3-within 16 km of shore
2-17-32 km from shore
1-greater than 32 km from shore

Outdoor recreation

3-within 16 km of shore
2-17-32 km from shore
1-greater than 32 km from shore

Cultural resources

3-within 16 km of shore
2-17-32 km from shore
1-greater than 32 km from shore

5. Summary of Matrix Analysis

The matrix presents the impact of structures and oil spills upon applicable resources and activities based on the sensitivity scales and in the case of oil spills weathering as it applies to potential impact upon living resources.

Impacts upon individual resource categories are totaled resulting in a cumulative impact. This is divided by the total possible value, resulting in an impact index. For example, tract number 64 has a cumulative impact for structures of 6 out of 12 possible for an impact index of .50 for structures. The same tract has a cumulative impact rating of 7.08 for oil spills out of a total possible of 24 for an impact index of .30. These are summed for an additive impact of .80.

The impact index and additive impact rating can be evaluated as follows:

Impact Index

1.00-0.78 Maximal potential impact
0.77-0.56 Moderate potential impact
0.55-0.33 Minimal potential impact

Additive Impact

2.00-1.44 Maximal potential impact
1.43-0.89 Moderate potential impact
0.88-0.33 Minimal potential impact

Table D-1 summarizes the tracts which fall into the categories of minimal, moderate, and maximal additive potential impact.

Table D-2 groups those tracts which have a maximal potential impact (sensitivity rating of 3) on specific resources or activities identified in the matrix. Fishing and shipping show high sensitivity to the potential development of the greatest number of tracts, 49 and 35 respectively. Aesthetics may be maximally effected by the leasing of 24 tracts and all other categories potentially involve 20 tracts or less.

Table D-1 Recapitulation of the Matrix Analyses

Additive Impact	Tract Number	Total Tracts
2.00-1.44 (Maximal)	85, 86, 87, 88, 101, 104, 108, 109, 110, 111, 116	11
1.43-0.89 (Moderate)	66, 70, 89, 95, 96, 97, 98, 99, 100, 102, 103, 112, 113, 114, 115, 117, 120	17
0.88-0.33 (Minimal)	1-65, 67-69, 71-84, 90-94, 105-107, 118, 119	92

Table D-2 Summary of Tracts with Maximal Potential Impacts on Specific Resources or Activities

Resource or Activity	Tracts Involved	Total Number
Littoral Systems	85, 86, 87, 88, 101, 102, 104, 108, 109, 110, 111, 112, 113, 115, 116	15
Reefal Systems	50, 55	2
Other Benthic Systems	85, 86, 87, 88, 89, 95, 96, 101, 104, 108, 116	11
Endangered Species	109	1
Sport and Commercial Fishing	12, 18, 22, 23, 24, 25, 26, 27, 36-45, 59-63, 66, 68, 73, 74, 79, 80, 85-89, 95-99, 101-105, 108-111, 116	49
Shipping	1, 2, 4, 5, 11, 22, 25, 26, 34, 35, 36, 37, 38, 40-43, 54, 57, 61, 62, 65, 66, 69, 70, 71, 87, 88, 101, 104, 111, 113, 114, 116, 120	35
Aesthetics	12, 59, 60, 73, 74, 79, 80, 85, 86, 87, 88, 95, 96, 101, 102, 104, 108-113, 115, 116	24
Outdoor Recreation	85, 86, 87, 88, 101, 102, 104, 108-113, 115, 116	15
Cultural Resources	85, 86, 87, 88, 101, 102, 104, 108-113, 115, 116	15

LEASE AREA IDENTIFICATION

PS - South Padre Island Area
PN - North Padre Island Area
MU - Mustang Island Area (Includes East Addition)
MI - Matagorda Island Area
BA - Brazos Area (Includes South Addition)
GA - Galveston Area (Includes South Addition)
HI - High Island Area (Includes East Addition, South Extension, South Addition)
WC - West Cameron Area (Includes West Addition, South Addition)
EC - East Cameron Area (Includes South Addition)
VR - Vermilion Area
SM - South Marsh Island Area (Includes South Addition)
EI - Eugene Island Area (Includes South Addition)
SS - Ship Shoal Area
PL - South Pelto Area
ST - South Timbalier Area
GI - Grand Isle Area (Includes South Addition)
WD - West Delta Area
SP - South Pass Area
MP - Main Pass Area
VK - Viosca Knoll Area (Formerly Mobile South No. 1)
MC - Mississippi Canyon Area (Formerly Mobile South No. 2)

CODE FOR ABBREVIATIONS ON MATRIX TABLES:

G - Gas prone tract
O - Oil prone tract
OG - Oil and gas prone tract
NA - Not Applicable
/ - Upper portion of each block pertains to impact from structures, lower portion pertains to impacts from possible oil spills.

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
1 PS 1041	27	37	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
2 PS 1051	26	37	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
3 PS 956	29	35	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
4 MU 765	37	37	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
5 MU 776	18	24	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	2 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67
6 MU 799	19	26	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	2 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58

1/ Tract designations in the matrix analysis tables are listed by tract number followed by the lease block identification Appendix A lists the tracts proposed for leasing in somewhat more detail.

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
7 MU 815	21	27	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	2 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
8 MU 857	24	29	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	2 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
9 MU 866	26	31	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
10 MU A22	56	62	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
11 MU A149	77	101	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
12 MI 487	16	18	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
13 MI 634	23	24	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	2 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
14 MI 657	19	22	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	2 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
15 MI 666	24	26	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	2 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
16 MI 679	48	48	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
17 MI 703	40	40	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
18 BA 488	18	18	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	2 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
19 BA A29	69	48	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
20 BA A77	66	51	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
21 BA A104	61	59	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
22 GA 212	21	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	2 / NA	NA / NA	NA / NA	9 / –	.75 / –	.75
23 GA 223	21	18	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	2 / NA	2 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67
24 GA 224	24	18	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	2 / NA	2 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
25	GA 225	27	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
26	GA 256	32	16	G	NA / NA	I / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
27	GA 282	21	18	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	2 / NA	2 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
28	GA 327	48	26	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50
29	GA 382	35	27	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50
30	GA 391	42	29	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
31	GA 392	40	29	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50
32	GA 393	37	27	G	NA / NA	I / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42
33	GA 420	40	29	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50
34	GA A129	106	51	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / -	.58 / -	.58
35	GA A158	109	53	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / -	.58 / -	.58
36	NI 71	27	13	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.66 / -	.66

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
37	HI 109	26	15	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
38	HI 196	40	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
39	HI 199	48	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	2 / NA	1 / NA	NA / NA	NA / NA	7 / -	.58 / -	.58
40	HI 207	37	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
41	HI 228	35	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
42	HI 231	47	16	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
43	HI 235	43	17	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
44	HI 75	32	13	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50
45	HI 76	32	13	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	1 / NA	NA / NA	NA / NA	6 / -	.50 / -	.50
46	HI A262	135	46	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42
47	HI A287	145	57	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42
48	HI A300	143	60	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
49	HI A347	180	71	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
50	HI A374	190	115	G	NA / NA	3 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
51	HI A381	171	91	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
52	HI A395	193	115	G	NA / NA	2 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
53	HI A468	137	59	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
54	HI A507	108	53	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
55	HI A512	124	59	G	NA / NA	3 / NA	NA / NA	NA / NA	2 / NA	2 / NA	1 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67
56	HI A522	151	70	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
57	HI A529	129	59	G	NA / NA	2 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67
58	HI A551	150	80	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42
59	WC 21	8	8	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67
60	WC 70	14	11	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
61	WC 83	19	12	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	2 / NA	NA / NA	NA / NA	9 / –	.75 / –	.75
62	WC 137	31	13	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	3 / NA	1 / NA	NA / NA	NA / NA	8 / –	.67 / –	.67
63	WC 138	29	13	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	1 / NA	NA / NA	NA / NA	6 / –	.50 / –	.50
64	WC 275	93	25	OG	NA / 1	1 / .54	NA / 1	NA / .54	2 / 1	2 / NA	1 / 1	NA / 1	NA / 1	6 / 7.08	.50 / .30	.80
65	WC 276	92	27	OG	NA / 1	1 / .54	NA / 1	NA / .54	2 / 1	3 / NA	1 / 1	NA / 1	NA / 1	7 / 7.08	.58 / .30	.88
66	WC 359	87	18	OG	NA / 1	1 / .54	NA / 2	NA / .54	3 / 2	3 / NA	1 / 1	NA / 1	NA / 1	8 / 9.08	.67 / .38	1.05

	TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
	Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
67	WC 374	90	21	OG	NA / .54	1 / .54	NA / 1	NA / .54	2 / 1	2 / NA	1 / 1	NA / 1	NA / 1	6 / 6.62	.50 / .28	.78
68	WC 376	85	20	OG	NA / .54	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	1 / 1	NA / 1	NA / 1	6 / 8.62	.50 / .36	.86
69	WC 385	97	27	OG	NA / .54	1 / .54	NA / 1	NA / .54	2 / 1	3 / NA	1 / 1	NA / 1	NA / 1	7 / 6.62	.58 / .28	.86
70	WC 428	116	33	OG	NA / .54	1 / .54	NA / 2	NA / .54	2 / 1	3 / NA	1 / 1	NA / 1	NA / 1	7 / 7.62	.58 / .32	.90
71	WC 510	135	50	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	3 / NA	1 / NA	NA / NA	NA / NA	7 / –	.58 / –	.58
72	WC 571	167	60	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / –	.42 / –	.42

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
73 EC 13	13	11	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
74 EC 14	11	11	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
75 EC 163	61	26	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42
76 EC 258	121	48	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42
77 EC 259	121	47	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42
78 EC 267	126	53	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
79 VR 18	6	9	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
80 VR 37	13	10	G	NA / NA	1 / NA	NA / NA	NA / NA	3 / NA	1 / NA	3 / NA	NA / NA	NA / NA	8 / -	.67 / -	.67
81 SM 20	61	22	OG	NA / .54	1 / .54	NA / .54	NA / 1	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 6.62	.42 / .28	.70
82 SM 105	117	56	OG	NA / .54	1 / .75	NA / .54	NA / 1	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 6.83	.42 / .28	.70
83 SM 106	116	55	OG	NA / .54	1 / .75	NA / .54	NA / 1	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 6.83	.42 / .28	.70
84 SM 133	132	62	G	NA / NA	1 / NA	NA / NA	NA / NA	2 / NA	1 / NA	1 / NA	NA / NA	NA / NA	5 / -	.42 / -	.42

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
85 EI (9 (25	11	4	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	1 / NA	3 / 3	NA / 3	NA / 3	8 / 19.08	.67 / .80	1.47
86 EI 11	11	4	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	1 / NA	3 / 3	NA / 3	NA / 3	8 / 19.08	.67 / .80	1.47
87 EI 39	11	4	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	3 / NA	3 / 3	NA / 3	NA / 3	10 / 19.08	.83 / .80	1.63
88 EI 56	14	5	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	3 / NA	3 / 3	NA / 3	NA / 3	10 / 19.08	.83 / .80	1.63
89 EI 92	43	10	OG	NA / .81	1 / .54	NA / 3	NA / .54	3 / 3	1 / NA	1 / 1	NA / 1	NA / 1	6 / 10.89	.50 / .45	.95
90 EI 174	64	25	OG	NA / .54	1 / .54	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 6.62	.42 / .28	.70

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
91 EI 353	126	83	OG	NA / .54	1 / 1	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 7.08	.42 / .30	.72
92 EI 363	126	95	OG	NA / .54	1 / 1	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 7.08	.42 / .30	.72
93 EI 364	126	95	OG	NA / .54	1 / 1	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 7.08	.42 / .30	.72
94 EI 372	130	101	OG	NA / .54	1 / 1	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 7.08	.42 / .30	.72
95 SS 61	13	6	OG	NA / 1	1 / .54	NA / 3	NA / .54	3 / 3	2 / NA	3 / 1	NA / 1	NA / 1	9 / 11.08	.75 / .46	1.21
96 SS 62	10	6	OG	NA / 1	1 / .54	NA / 3	NA / .54	3 / 3	2 / NA	3 / 1	NA / 1	NA / 1	9 / 11.08	.75 / .46	1.21

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
97 SS 110	27	16	OG	NA / 2	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	1 / 2	NA / 2	NA / 2	6 / 13.08	.50 / .55	1.05
98 SS 118	27	16	OG	NA / 2	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	1 / 2	NA / 2	NA / 2	7 / 13.08	.58 / .55	1.13
99 SS 136	29	15	OG	NA / 2	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	1 / 2	NA / 2	NA / 2	6 / 13.08	.50 / .55	1.05
100 SS 202	61	33	OG	NA / .54	1 / 1	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 7.08	.42 / .30	.72
101 PL 5	10	10	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	3 / NA	3 / 3	NA / 3	NA / 3	10 / 19.08	.83 / .80	1.63
102 PL 15	16	14	OG	NA / 3	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	3 / 3	NA / 3	NA / 3	8 / 17.08	.67 / .71	1.38

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
103 PL 22	21	17	OG	NA / 2	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	2 / 2	NA / 2	NA / 2	7 / 13.08	.58 / .55	1.13
104 ST 11	6	7	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	3 / NA	3 / 3	NA / 3	NA / 3	10 / 19.08	.83 / [illegible]	1.63
105 ST 184	40	18	OG	NA / .87	1 / .54	NA / 2	NA / .54	3 / 2	1 / NA	1 / 1	NA / 1	NA / 1	6 / 8.95	.50 / .37	.87
106 GI 83	45	47	OG	NA / .78	1 / .87	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 7.19	.42 / .30	.72
107 GI 92	61	71	OG	NA / .54	1 / .87	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 6.95	.42 / .29	.71
108 WD 26	8	9	OG	NA / 3	1 / 1	NA / 3	NA / 1	3 / 3	1 / NA	3 / 3	NA / 3	NA / 3	8 / 20	.67 / .83	1.50

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
109 WD 33	16	19	OG	NA / 3	1 / .60	NA / 2	NA / 3	3 / 2	1 / NA	3 / 3	NA / 3	NA / 3	8 / 19.64	.67 / .82	1.49
110 WD 47	16	15	OG	NA / 3	1 / .78	NA / 2	NA / 2	3 / 2	1 / NA	3 / 3	NA / 3	NA / 3	8 / 18.78	.67 / .78	1.45
111 SP 29	8	18	OG	NA / 3	1 / .87	NA / 2	NA / .54	3 / 2	3 / NA	3 / 3	NA / 3	NA / 3	10 / 17.41	.83 / .73	1.56
112 SP 36	10	37	OG	NA / 3	1 / .78	NA / 1	NA / .54	2 / 1	2 / NA	3 / 3	NA / 3	NA / 3	8 / 15.32	.67 / .64	1.31
113 SP (39 (42 (43	5	33	OG	NA / 3	1 / 1	NA / 1	NA / .54	2 / 1	3 / NA	3 / 3	NA / 3	NA / 3	9 / 15.54	.75 / .65	1.40
114 MP 60	19	22	OG	NA / 2	1 / .54	NA / 1	NA / .54	2 / 1	3 / NA	2 / 2	NA / 2	NA / 2	8 / 11.08	.67 / .46	1.13

TRACT DATA				RESOURCE AND ACTIVITIES									IMPACT		
Tract Number Lease Block Location 1/	Distance from Shore (kilometers)	Approximate Depth (meters)	Estimated Type of Production	Littoral Systems	Reefal Systems	Other Benthic Systems	Endangered Species	Sport and Commercial Fishing	Shipping	Aesthetics	Outdoor Recreation	Cultural Resources	Cumulative Impact	Impact Index	Additive Impact
115 MP 77	6	37	OG	NA / 3	1 / .54	NA / 1	NA / .54	2 / 1	2 / NA	3 / 3	NA / 3	NA / 3	8 / 15.08	.67 / .63	1.30
116 MP 102	13	7	OG	NA / 3	1 / .54	NA / 3	NA / .54	3 / 3	3 / NA	3 / 3	NA / 3	NA / 3	10 / 19.08	.83 / .80	1.63
117 VK 944	32	150	OG	NA / 2	1 / .54	NA / 1	NA / .54	2 / 1	2 / NA	1 / 2	NA / 2	NA / 2	6 / 11.08	.50 / .46	.96
118 VK 774	58	110	OG	NA / .54	1 / .54	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 6.62	.42 / .28	.70
119 MC 267	51	183	OG	NA / .66	1 / 2	NA / 1	NA / .54	2 / 1	1 / NA	1 / 1	NA / 1	NA / 1	5 / 8.20	.42 / .34	.76
120 MC 149	19	183	OG	NA / 2	1 / 1	NA / 1	NA / .54	2 / 1	3 / NA	2 / 2	NA / 2	NA / 2	8 / 11.54	.67 / .48	1.15

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